The Annals

of the American Academy of Political and Social Science

Standards in Industry

[illegible] recent development of standards of product, material, equipment, and particularly [illegible] industry and the effect of them on [illegible] conditions

EDITED IN CO[illegible] THOMAS S. [illegible]

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CXXXVII MAY, 1928 Number 226

Standards in Industry

The Annals

VOLUME CXXXVII MAY, 1928

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THE AMERICAN ACADEMY OF POLITICAL AND SOCIAL SCIENCE
3622–24 LOCUST STREET
PHILADELPHIA
1928

EUROPEAN AGENTS

ENGLAND: P. S. King & Son, Ltd., 2 Great Smith Street, Westminster, London, S. W.
FRANCE: L. Larose, Rue Soufflot, 22, Paris.
GERMANY: Mayer & Müller, 2 Prinz Louis Ferdinandstrasse, Berlin, N. W.
ITALY: Giornale Degli Economisti, Milano, via Canova, 27.
SPAIN: E. Dossat, 9 Plaza de Santa Ana, Madrid.

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FOREWORD

THAT the development of standards in industry has been one of the most significant phases of the new industrial management has come to be known to even those who have but a passing knowledge of modern industrial conditions. Standards of product, of material, of equipment, and of performance, have come to be the bases on which the manager of today erects much of the coördination which distinguishes the business of today from that of just a few years back. They also form the groundwork of many steps towards better industrial relations. Standards are base lines of management, without them individual companies and whole industries find operating costs and attendant selling prices high, and with them the consumer shares in the accompanying prosperity.

For the general reader, who has not had a knowledge of the manner in which standardization has permeated the very fabric of industry, this volume of *The Annals* should provide interesting insight into the methods and extent of standardization. For those who have been giving their time and energy to standardization and simplification, this volume should provide a measuring stick to gauge the progress that has been made. That there are limitations to the extent of standardization is fully realized by all who have been associated in the work, and those articles which dwell on this phase should serve as a ready reference check on enthusiasms which carry a good cause to extremes.

Three great groups have been carrying forward standardization work within the United States. The United States Department of Commerce and the Chamber of Commerce of the United States have coöperated in leadership in simplification of product. The American Engineering Standards Committee, and its allied bodies, have led the development of materials and equipment standardization. The management societies have shared the leadership in equipment standardization, and have pointed the way to the development of performance standards in industry. Progress has been made in Canada and in Europe, and particular conditions on the Pacific Coast of the United States have called for particular methods.

The first part of this volume contains articles by the leaders who have brought about the work of these groups. In addition, it includes articles on the importance of standardization to the economic life of the country, the reactions of organized labor, and the contributions of particular groups to particular types of standards.

The second part indicates the manner in which specific industries have approached their standardization problems, and the progress that has been made. Such varied industries as machine shops, electrical goods, printing, textiles, music, filing equipment, gas appliances, and railroads, have varied problems that indicate that different approaches must be made toward solution. Although the industries which are included are only typical of many others in which progress has been made, nevertheless, they will serve to show the diversity of the problems which have been attacked and solved.

The third part indicates the widespread interest in standardization outside of industry. Although the standardization programs outside of industry affect industry itself, the gains that

are made are secured in as diverse conditions as those which obtain in government departments, the farm, the home, the hotel, and the hospital. Articles covering these phases have been included.

Part four relates to the interest of the consumer in standardization, and steps that are being taken by the government to protect the consumer through certification of standard specifications. Although it has been assumed that the consumer requires diversity to fill individual wants, this has not been borne out by recent study, and the advantages incident to sane standardization are indicated by the articles in this part, which have been prepared by men who have given intense study to this phase of the economic values of standardization.

RICHARD H. LANSBURGH.

Organized Effort in Simplification

By Ray M. Hudson

Assistant Director, Commercial Standards, U. S. Bureau of Standards, Department of Commerce, Washington, D. C.

EVER since mass production began to assume an important place in the science of manufacture, attempts have been made to reduce industrial losses by applying some form of simplification. These were, in most cases, sporadic, individual efforts of limited scope. In the last ten years, important advances in technique have broadened the field of application so as to embrace whole industries and to build up methods of maintaining a continuous sales pressure on behalf of simplification. Thus the principles of mass production have in a sense been applied to waste elimination itself.

While clearer and more general appreciation of the value of intelligent management is the underlying cause of this improvement, several other factors have contributed greatly to the present satisfactory state of affairs. Individual industrialists are showing a coöperative attitude toward their competitors that constantly astonishes observers abroad. Competition between industries has helped bring this about, but teamwork has also had an opportunity to demonstrate that many problems and difficulties are the common property of an entire business and may only be surmounted by group action. The activities of trade associations and technical societies are constantly widening in scope, and several agencies of the Federal Government are making useful contributions in fields to which their efforts may properly be applied.

Naturally this rapid expansion has been attended by excursions into numerous byways and the development of many new economic doctrines. Some conflict and overlapping has resulted but, when not maintained too long, has done little harm. Out of a wealth of new terms, three seem to have established themselves in the vocabulary of political economics as defining work which cannot be described as standardization. These terms are simplification, rationalization, and simplified practice. It is with the last of these that this paper deals because it signifies an organizing of simplification on a national scale. It means the voluntary action of an industry, or group of industries, with the assistance of the Department of Commerce, to eliminate waste by reducing unnecessary variety of sizes and types of stock products.

Post-War Conditions

The five years immediately following the World War were marked by a tendency on the part of industry to return to the old uneconomic conditions of over-diversity. Many products which had been simplified by the Conservation Division of the War Industries Board were again offered in a bewildering variety of sizes, types and shapes in an effort to break the "buyers' strike" of 1919 and 1920. In the scramble for sales volume during the industrial depression of 1921 this condition was so aggravated as to suggest a study of the situation with a view to possible remedies.

Waste in Industry

The Federated American Engineering Societies, through Herbert Hoover, its president, appointed a committee which made a careful survey of the

wastes in six industries which seemed to present typical conditions. The findings, printed under the title "Waste in Industry," showed the losses to be approximately as follows:

	Per Cent
Metal trades	29
Boot and shoe manufacturing	41
Textile manufacturing	49
Building	53
Printing	58
Men's clothing	64
Average	49

These figures indicated that practically one half of the material, labor, energy, and human effort expended in these industries was being lost, or wasted, *i.e.*, spent without tangible return. If, as the committee believed, the waste in these six industries was typical of all the industries in the United States, with their annual output of more than $60,000,000,000 of manufactured goods, it is easy to see the tremendous cost of this waste to the average citizen who, in the last analysis, must bear his share of the loss. It was recognized that all of this waste is not avoidable; some of it can never be overcome, but subsequent experience has proven that the total can be reduced. The major causes for waste in industry are:

1. Low production due to faulty management of materials, machinery, equipment, and men.
2. Interrupted production caused by idle men, idle materials, idle plants, and idle equipment.
3. Restricted production intentionally caused by owners, management or labor.
4. Lost production caused by ill health, physical defects, and industrial accidents.

In assaying the relative responsibility, the committee estimated that 50 per cent of this waste was chargeable to management, 25 per cent to labor, while the remainder was due to conditions not directly controllable by either group. Management has the greatest opportunity, hence responsibility, for eliminating waste in industry. The opportunity and responsibility of labor is no less real though smaller in degree.

Later, as Secretary of Commerce, Mr. Hoover organized several agencies within the Department to assist in eliminating avoidable waste. These activities are coöperative and function only at the request of the industry concerned. They operate on the principle that if the producers, distributors and consumers of a commodity can meet and develop a program of simplification which will be of benefit to all concerned, the Department of Commerce is glad to assist in securing its general adoption and in seeing that it is subjected to periodic review so as to keep it in accord with the best current practice.

This form of participation by a neutral agency safeguards the particular interests of each affected group, widens the scope of the program and affords the advantages of expert technical aid where necessary. The cooperation of non-governmental technical societies, of trade associations, and of allied industries permits organization not otherwise possible.

SIMPLIFIED PRACTICE RECOMMENDATIONS

As the country's largest consumer of manufactured products, the Federal Government, by coördinating its own requirements, is applying simplification to the purchase of commodities valued at $1,000,000,000 annually. This work is carried on through the Chief Coordinator, the General Supply Committee, etc. In many cases it is also possible to enlist the support of state and municipal purchasing agencies.

The development of a Simplified Practice Recommendation under the auspices of the Department of Commerce starts with a determination of the existing production and sales trends. This is ascertained through surveys conducted by committees which are appointed by the industry concerned, from its own membership. From these surveys there is drafted a tentative recommendation, which serves as an agenda for a general conference of all interests. This general conference of representative manufacturers, distributors, and users, discusses the individual items and phases of the agenda, from the viewpoint of each group represented, and then approves a recommendation that is satisfactory to all concerned.

Following the conference the recommendation is then presented to the entire industry by letter referendum for its approval and written acceptance. The publication and endorsement of the recommendation by the Department of Commerce is dependent upon acceptance of the program by at least 80 per cent by volume of each group concerned.

The Division of Simplified Practice of the Department of Commerce, since its establishment in 1922, as a part of the Bureau of Standards has promulgated recommendations, developed by the respective industries, which have effected the following reductions in stock items:

SIMPLIFIED PRACTICE APPLIED TO MILL SUPPLIES, SHOP EQUIPMENT, ETC.

Commodity	Formerly	Now	Reduction Per Cent
Files and rasps	1,351	496	65
Forged tools	665	351	47
Plow bolts	1,500	840	44
Sheet steel	1,819	263	85
Milling cutters			35
Die heads, self-opening			75
Grinding wheels	715,200	255,800	64
Average reduction			59

SIMPLIFIED PRACTICE APPLIED TO CONSTRUCTION MATERIALS

Commodity	Formerly	Now	Reduction Per Cent
Paving bricks	66	4	94
Asphalt	102	10	90
Steel reinforcing bars	40	11	72½
Metal lath	125	24	81
Woven wire fence	552	69	87
Asbestos mill board	10	5	50
Eaves trough and conductor pipe	21	16	24
Concrete building units	115	24	80
Sand lime brick	14	3	78½
Roofing slate	98	48	51
Average reduction			71

SIMPLIFIED PRACTICE APPLIED TO BUILDING MATERIALS, EQUIPMENT, FITTINGS, ETC.

Commodity	Formerly	Now	Reduction Per Cent
Face brick, smooth	36	1	97
Face brick, rough	39	1	97½
Common brick	44	1	98
Lumber, soft wood, yard sizes			60
Hollow building tile	36	19	47½
Builders' hardware	Items 26%	Finishes	71
Sidewalk lights—sizes	120	6	95
Paint and varnish brushes	480	138	71
Blackboard slates	251	25	90
Tacks and nails	428	181	58
Average reduction			72½

SIMPLIFIED PRACTICE APPLIED TO GENERAL SUPPLIES AND FURNISHINGS FOR HOMES, HOTELS, HOSPITALS, CLUBS, ETC.

Commodity	Formerly	Now	Reduction Per Cent
Beds, mattresses, springs	78	4	95
Bed blankets	78	12	85
Sterling silver, flatware	190	62	67
Tinware, galvanized and japanned	1,154	873	24
Milk bottles	49	9	82
Milk bottle caps	29	1	96
Hotel chinaware	700	160	77
Restaurant chinaware	668	177	73
Dining car chinaware	700	113	84
Hospital beds	67	4	94
Steel lockers	65	17	74
Average reduction			70½

SIMPLIFIED PRACTICE APPLIED TO PLUMBING

Commodity	Formerly	Now	Reduction Per Cent
Structural slate for plumbing purposes (Estimated)	....	..	84
Range boilers	130	13	90
Hot water storage tanks	120	14	88
Brass lavatory and sink traps	1,114	72	94
Average reduction			89

SIMPLIFIED PRACTICE APPLIED TO BUSINESS DOCUMENTS

Warehouse receipt, stock and delivery forms, etc.	Each previously made in a thousand different forms.
Invoice, inquiry and purchase order forms	There is now one Standard Form for each of these documents.
Bank checks, notes, deposit slips, notices, etc.	
Average reduction	"99 44/100%" (Estimated)

Leaders of several of the industries affected have made the following estimates of the savings resulting from the above simplifications:

That simplified practice yields benefits sufficiently attractive to the manufacturers, distributors and consumers, is demonstrated by the high degree

Field	Varieties Reduced		Estimated Annual Saving
	From	To	
Paving brick	66	4	$1,000,000
Sheet steel	1,819	261	2,400,000
Reinforcing bars	40	11	4,500,000
Warehouse forms	3,500*	18	5,000,000
Range boilers	130	13	5,500,000
Builders' hardware	100% Items	74% Finishes 29%	10,000,000
Invoice, inquiry and purchase order forms	4,500*	3	15,000,000
Lumber—yard sizes	100%	40%	250,000,000
Total			$293,400,000

*Estimated.

ADHERENCE

The establishment of these recommendations is, however, only a beginning. Obviously the schedules must be followed or they will benefit no one. To assist in increasing the scope of application and maintaining adherence, the respective industries appoint standing committees from among their own memberships. The conference also fixes a period, usually from six months to two years. At the expiration of this period the whole program is reconsidered to see if any changes are necessary in order that the schedule shall conform with the best current practice of the industry.

of adherence shown the recommendations. Re-surveys of fifteen recommendations were conducted during the last quarter of the calendar year 1927 and showed an average degree of adherence of 82.61 per cent.

BENEFITS

An analysis of the advantages which have accrued to industry as a result of this movement may be briefly summarized as follows:

To the manufacturer, simplified practice means:

1. Less capital tied up in raw materials, semi-finished stock, storage space and repair parts.

2. More economical manufacture through larger units of production, reduced number of manufacturing units, larger runs, less frequent changes, higher rates of individual production, accurate and proper estimating for production, more effective stock control.
3. Better and simplified inspection, less idle equipment, reduced amount of equipment, greater ease in securing raw materials and conserving raw products, and cheaper handling of stocks.
4. Reduced clerical overhead, simplified and more accurate cost accounting system, elimination of waste in experimentation and design, standardized material inventories, more efficient labor due to making training of employes more simple.
5. Better earnings, through increased individual production, made possible by longer runs, happier and more contented workmen, skill increased by repetitive process, less labor idle from preventable causes, more permanent employment as contrasted to present seasonal employment, less difficulty in getting help.
6. Better service to the trade in better quality of product, more prompt delivery, decreased quantity of sizes of packing required, fewer packages broken in transit, less chance of errors in shipment, less obsolete material, more efficient sales force, increased rate of turnover, intensified sales momentum, easier financing, fewer factory shutdowns, compels attention to individuality in those features where there should be individuality, discourages attempts to apply it to those features where it is superficial and useless and where standardization and quality should prevail, earlier plans and schedules, and decrease in number of production processes.

To the distributor the adherence to simplified practice will mean:

1. Increased rate of turnover due to all live numbers.
2. Elimination of slow-moving stock, staple line, easy to buy and quick to sell, more effective sales force, greater concentration of sales on fewer items and standard patterns that are proven best sellers.
3. Decreased capital investment in stock on hand, repair parts on hand, storage space required, less stock depreciation and obsolescence, decreased overhead on handling charges, clerical work, better service through lower prices, quicker and more reliable deliveries.

Gains to the ultimate consumer through simplified practice are:

1. Better prices than would otherwise be possible.
2. Better quality of product through ability of manufacturer to concentrate on better design and through the reduction of manufacturing expenses.
3. Better service and prompter delivery of new equipment, replacements, and repair parts.

Further evidence that simplification is proving of great value to manufacturers and purchasers is found in the increased number of associations accepting the completed recommendations. The list of associational endorsers grew from 686 to 898 during 1927, the individual concerns, from 2,775 to 6,676. This means an increasing number of industrial purchasers are specifying simplified lines when buying, because they are finding that

such items are usually more readily obtained; that their quality is better; and, in many instances, by reason of the savings wrought through simplification, prices are lower. It must be remembered that savings from adoption of the simplified lines are obtained by the small manufacturers as well as the large, and also by the public.

A survey of the benefits to acceptors from simplified practice recommendations has brought to light many cases of definite money savings. One metal lath manufacturer reports reduction of $140,000 in his inventory, while a manufacturer of eaves trough and conductor pipe reports a $30,000 reduction in his inventory. One community reports savings of five cents per square yard, and another 25 cents per square yard, on its paving due to asphalt grade simplification. One lumber company reports reduction of $250,000 on its inventory, another $474,000 due to lumber standardization program. A manufacturer of concrete building units reports savings of $11,500 per year due to simplification in his field, while another reports savings of $500 in his office operations alone, and another states it has enabled him to reduce the selling price of his product 25 per cent. A manufacturer of die head chasers cites a 20 per cent reduction in his inventory, another 65 per cent. Many others report better turnover, quicker delivery, and improved service to the trade as benefits accruing from simplified practice.

ALLIED ACTIVITIES

American Marine Standards Committee

Within the Division of Simplified Practice there is a unit known as the American Marine Standards Committee, the activities of which embrace standards relating to the design, construction, and manufacture of hulls, machinery, equipment and fittings for ships and port facilities, also supplies for their maintenance and operation. This committee has completed twenty-nine marine standards as follows:

Glass for air ports and fixed lights; mooring bitts—cast iron; fixed lights for ships; rigging screws for ships; ship fittings for decks and riggings; cargo handling gear for ships; kinds and sizes of hose for ship equipment; specifications for ¾″ and 2″ flexible metallic hose; specifications for 2½″ double-jacketed cotton rubber-lined fire hose; specifications for 2½″ unlined linen fire hose; instructions for care and maintenance of steel hulls; general instructions for operation, care and upkeep of Scotch type marine boilers; kinds and sizes of mattresses and pillows and woolen, linen and cotton articles for ship equipment; kinds and sizes of glassware for ship equipment; kinds and sizes of silverware for ship equipment; distinctive markings for piping; specification for 2½″ single-jacketed cotton rubber-lined fire hose; essential machinery spare parts; accessories and supplies for sea-going ships; equipment and methods for safety on ships; general instructions for operation, care and upkeep of water tube marine boilers; condenser tube ferrules and tube sheets; specifications for pressure and vacuum gauges for ships; mooring bitts—cast steel; hubs for built-up propellers; fairwater caps for propeller hubs; propeller hub studs, nuts and lock screws; packing gland for propeller hubs; specifications for fire clay refractories for marine services; and lifeboat sizes.

COMMERCIAL STANDARDS GROUP

During the past year the simplification work reached the point, where more effectively to serve industry there was created within the Bureau of Standards, a "Commercial Standards

Group" under an assistant director of the Bureau, of which group the Division of Simplified Practice is now a part. The activities of this group will include the coördination of simplification and commercial standards programs with particular reference to the needs of an industry.

In addition, the correlation of the work of the Federal Specifications Board with commercial practice, and liaison duties with other branches of the Department of Commerce, and with other Government departments in questions relating to commercial standards, will be included in this group. In formulating plans and policies for the guidance of the activities of the Commercial Standards Group, the assistant director is aided by a planning committee, which meets quarterly in the Department of Commerce.

INTERNATIONAL ASPECTS OF SIMPLIFICATION

The value of the exports of the United States during the past three years averaged about four billions, seven hundred millions of dollars of which 43 per cent went to English-speaking countries; 17 per cent to Teutonic- and Slavic-speaking; and 30 per cent to Spanish-, French-, Italian- and Portuguese-speaking countries. This brings out the importance of translating certain of our standards into these foreign languages, wherever the commodity has a foreign market. Several foreign countries, whose volume of exports reach important figures, have distributed translations of their national standards abroad. The British have done some notable work along this line, expending, according to a statement of an official of the British Engineering Standards Association, more than 20,000 pounds Sterling for publications in Spanish, French, Italian and Portuguese languages and for the strategic spreading of these in overseas countries.

Obviously, the sponsorship for translating, publishing and distributing of American standards can be done more efficiently by one central agency than by a number of individual agencies. A group of industries and organizations have indicated that the work could be effectively carried out under the auspices of the Department of Commerce, which now maintains a field staff for promotion of commerce abroad.

The Relation of the Chamber of Commerce of the United States of America to the Growth of the Simplification Program in American Industry

By E. W. McCullough

Manager, Department of Manufacture, Chamber of Commerce of the United States of America

WE have acquired the habit of reckoning the dates of unusual happenings in business and industry within the last ten years from the World War. So may we even more properly designate that period as the beginning of the Elimination of Waste in Industry through Simplification and Standardization.

In the years just preceding the war there was a very noticeable tendency to multiply in commodity manufacture the variety of kinds and sizes in response to a demand, fancied or real, from distributors and consumers. "The Customer is Always Right" almost became a slogan in industry in carrying such service to the extreme. Factories were fast becoming custom shops in some lines through a competition which was permitting the buyer not only to depart from recognized standards but to specify such variations as his fancy might dictate.

This was the situation when the Government called for the coöperation of industry in the winning of the war. It was also one of the primary causes for the creation of the War Industries Board, a part of the Council for National Defense. I shall not attempt to review in detail the methods of the Government in handling its war planning, except to note that the Chamber in behalf of business took early cognizance of the planning and both tendered and rendered assistance at every step.

It was soon found that all ordinary methods of requisitioning supplies used in peace times were inadequate, and that industry as a whole should be mobilized, coördinated, and gotten into a coöperative state in order that there might be an uninterrupted flow of supplies.

Organization of Industrial Committees

In September, 1917, the Chamber, at its War Convention of American Business, held in Atlantic City, discussed the committee system and unanimously endorsed the idea that each industry should organize a committee of its own which should be properly representative in character to coöperate with the Government in every way. This conclusion was brought to the attention of the Council of National Defense for its reaction, with the result that the idea was heartily endorsed. The Chamber then emphasized to its membership the appointment of committees of this character, and succeeded in bringing about the organization of more than 300 of them, representing practically every important line of industry and a large number of minor or collateral lines.

The experience of the members of these committees, which were largely made up of executives of the several industries, opened their eyes as to the danger which they had been drifting into prior to the war in permitting the increasing of their varieties, which also meant the insidious reduction of volume, thereby decreasing their plant

efficiency and greatly increasing their costs. Following the signing of the Armistice and the gradual withdrawing of the hand of the Government in dictating production, there appeared a tendency toward returning to old ways, but this was checked effectively as will be shown by the Chamber and also the Department of Commerce.

SIMPLIFICATION DURING THE WAR PERIOD

During the operations of the War Industries Board, the varieties of sizes and kinds in many lines were drastically cut. Especially was this true in all articles required for personal wear. The number of colors of leather used in the making of shoes was greatly reduced, the quantities and shades of cloth in men's clothing were also curtailed. The varieties of farm equipment used in the production of raw foods were lowered. In fact, variety limitation was strictly enforced in practically all commodities approved by the Government as necessaries.

SIMPLIFICATION AFTER THE WAR PERIOD

The value of this war-time experience was not lost upon many members of these war service committees, and there soon appeared organized resistance within industry to check any tendency toward backward steps in again injecting into production a ruinous number of variations.

About this time—or, to be exact, in 1920—the Directors of the Chamber, at their annual meeting held at St. Louis, created eight service departments for the purpose of aiding members of the Chamber engaged in business and industry in dealing with their more intimate problems. These eight departments were designed to cover the following fields:

Civic Development
Domestic Distribution
Finance
Foreign Commerce
Insurance
Manufacture
Natural Resources Production
Transportation and Communication

These departments were placed under the direction of managers experienced in handling problems falling within the designation of their departments, and back of the manager was provided advisory committees of from ten to fifteen executives of outstanding concerns in business and industry, and back of these committees was the underlying membership of the Chamber, numbering approximately between six and seven hundred thousand organizations, partnerships and individuals, making up the underlying membership of the Chamber, all coördinated and coöperating for waste elimination in business.

Both the Chamber and the Department of Commerce seemed to have recognized the desirability of giving attention to Simplification in Industry simultaneously, for on the first program of the Department of Manufacture, Simplification and Standardization appears on its list of major activities. Shortly afterward, in coöperation with Secretary Hoover, the Manager of this Department was invited and accepted a place on the Planning Committee for the Division of Simplified Practice of the Department of Commerce.

From that time, and still continuing, this relation exists, although at this time to avoid duplication of activities, the Department of Manufacture acts more particularly as a liaison agency in promoting in industry interest in simplification, while the Division of Simplified Practice of the Department of Commerce, well organized, with an efficient staff and increased appropria-

tions, attends to the mechanics of the operation to reduce waste in industry through the simplification of varieties and the elimination of sizes, kinds, and varieties which have become obsolete. It is obviously a wonderful aid to progress in that through these eliminations room is made for initiative and improvement.

SIMPLIFICATION APPLIED TO THE BRICK INDUSTRY

In these joint efforts between the Department of Commerce—representing government—and the United States Chamber of Commerce—representing business—the first undertaking in simplification was applied to the paving brick industry. This was in 1922, and at that time the National Paving Brick Manufacturers Association determined by survey that its various members were making varieties in the aggregate amounting to 66 sizes, styles and kinds. The industry, at its request, was called together to consider the survey made and at the first meeting reduced these varieties from 66 to 11. There were present at that meeting, not only manufacturers, but road builders, municipal and civil engineers, trade publications representing the industry,—in fact, the doors were open to all who might have an interest in the undertaking. In keeping with the practice set up, a Continuing Committee was appointed to meet annually or oftener, as might be necessary, to re-survey the situation and determine whether the eliminations would remain as decided, or be adjusted to meet conditions developed during the interim. This Committee has met annually since, and the varieties have suffered further reduction to 4. But at the last meeting of the Committee, it was decided that the demand for thinner brick had so increased that at least two sizes should be restored to the schedule. Among the other commodities dealt with under the same plan and methods, the following are typical:

Beds, springs and mattresses reduced from 78 varieties to 4.
Metal lath reduced from 125 varieties to 24.
Hotel chinaware reduced from 700 varieties to 160.
Files and rasps reduced from 1351 varieties to 496.
Rough face brick reduced from 39 varieties to 1.
Smooth face brick reduced from 36 varieties to 1.
Common brick reduced from 44 varieties to 1.
Range boilers reduced from 130 varieties to 13.
Woven wire fencing reduced from 552 varieties to 69.
Milk bottles reduced from 49 varieties to 9.
Bed blankets reduced from 78 varieties to 12.

Nor has the work of waste elimination through simplification stopped with the large variety of commodities, but has followed through into methods and practices in manufacture, into office supplies, lumber standards, publications—in fact, almost everywhere that elimination and standardization will reduce costs and unnecessary overheads.

SIMPLIFICATION AN AID TO ADVANCEMENT

During the brief period covered by the last five years, we have witnessed the marvelous development of American industry, which has placed us in the front rank, as leaders, bringing with it prosperity to all classes of our people and placing within the reach of all, not only those things which are required to satisfy human needs under our present standards of living, but an abundant measure of so-called luxuries as well. In rechecking the causes which have contributed to our ad-

vancement and success, certainly Simplification is worthy of a place near the top of the list, for it has made possible our advance in standards of living many years before such a situation could possibly have obtained under methods and practices which existed prior to the war.

The Chamber of Commerce of the United States of America has recently taken another advance step in Simplification in establishing for its members a service by which business ethics may be advanced and trade relations established to meet existing conditions. Thus, step by step, American business and industry is progressing along better lines and our leadership will never be jeopardized while we have the vision to observe waste occurring and take practical steps to eliminate it.

Work of the American Engineering Standards Committee

By P. G. Agnew

Secretary, American Engineering Standards Committee

THERE are literally hundreds of organized groups engaged in industrial standardization work in this country. By and large, this group standardization movement has developed during the present century. It has been a natural outgrowth of company standardization, which has been one of the most marked characteristics of our industrial growth.

Just as company standardization led to standardization by groups, so the latter inevitably necessitates intergroup or national standardization. The World War created a situation in all industrial countries which made clearly apparent the necessity of a national standardization clearing house.

The first step toward a national organization was taken in 1918 by five national engineering societies, which together with the U. S. Government Departments of War, Navy and Commerce, formed the nucleus of such an organization. Later, this nucleus was broadened into a federation of trade associations, technical societies, and Government departments.

The American Engineering Standards Committee is primarily concerned with national and international standardization. It is the agency through which industrial standardization in this country is passing from the second to the third stage, namely, from standardization by associations, societies, and governmental agencies, to standardization on a national scale. Through its method and procedure, which are the result of extensive study and discussion on the part of the numerous bodies concerned, and which have been further developed through eight years of experience, the standardization work of the many bodies concerned is being broadened and unified into a consistent system of national industrial standards.

Nature of the Work

A broad range of industries and of types of standards is covered. This includes:

1. Nomenclature. Definitions of technical terms used in specifications and contracts and in other technical work.
2. Uniformity in dimensions necessary to secure interchangeability of parts and supplies, and the interworking of apparatus.
3. Quality specifications for materials and equipment.
4. Methods of test.
5. Ratings of machinery and apparatus which establish test limits under specified conditions as a basis of purchase specifications, or which establish requirements as to performance, durability, safety, etc., under operation.
6. The codifying of provisions for safety.
7. Rules for the operation of apparatus and machinery in industrial establishments.
8. Concentration upon the optimum number of types, sizes, and grades of manufactured products.

METHOD OF WORK—MINIATURE INDUSTRIAL LEGISLATURES

The method of work is simply a systematic plan of coöperation by which all organizations interested in any particular project participate, (1) in deciding whether the work shall be undertaken at all, (2) in formulating the standard, and (3) in its ultimate approval as an "American Standard." The number of organizations having a substantial interest in any particular project is surprisingly large even in specialized subjects. For example, eleven national organizations were officially represented on the sectional committee which brought about national unification of specifications for railroad ties.

In more general subjects which may permeate a large number of industries, the problem is more difficult. For example, it has been found necessary in subjects like pipe flanges and fittings, or bolts and nuts, to accord official representation to thirty or more national organized groups. It is evident that in all such cases the detailed work must necessarily be done in subcommittees. In each of the three subjects just mentioned several years of intensive work were required to bring about a true national consensus. Agreement has been reached, after long and painstaking effort, on a group of detailed standards for bolts and nuts, and on another group for pipe flanges and fittings. In each case a uniform national specification was brought about by practically unanimous action in the sectional committee, and received formal approval of the central organization as an American Standard.

Each of these sectional committees, upon which all interested groups are represented, and in which decisions are reached, is essentially a miniature industrial legislature organized upon a subject basis instead of upon a geographic basis. This is equally true whether the subject is a safety code which may be adopted for legal regulation by a state commission, a quality specification for a building specification, a method of test to determine whether the material is in compliance with specifications, or a dimensional standard whose purpose is to secure interchangeability of parts and supplies.

After eight years of experience in active work the procedure has just been revised to make it more liberal and flexible. In the past, each sectional committee has worked under the administrative support and direction of one of the bodies most concerned with the subject. Such a body is called a "sponsor."

A special provision for the approval of existing standards has now been broadened to provide for the revision of such standards wholly under the direction of the originating organization, provided that a consensus of all those groups substantially concerned with the scope and provision in those standards can be shown. Such standards are said to be under "proprietary sponsorship." On the other hand, provision is now made for autonomous sectional committees, which will report directly to the central organization.

WORK ACCOMPLISHED

Thirty-six national organizations, including nine technical societies, seven departments of the Federal Government, and twenty trade associations, now constitute the organization. The American Engineering Standards Committee itself, usually referred to as the "Main Committee," which is the chief executive and policy-forming body, at present consists of sixty-three members, representing the thirty-six national organizations.

One hundred and three standards have been approved, and more than 160 others are in process. Following is a classified list of these undertakings:

	Number of Projects	*Number Approved*
A. Civil Engineering and Building Trades	34	14
B. Mechanical Engineering	72	26
C. Electrical Engineering	44	13
D. Automotive	5	4
E. Transportation	10	9
F. Naval Architecture, etc.	1	..
G. Ferrous Metallurgy	4	3
H. Non-Ferrous Metallurgy	10	6
K. Chemical Industry	8	6
L. Textile Industry	3	..
M. Mining	19	6
O. Wood Industry	5	4
P. Pulp and Paper Industry	2	1
Z. Miscellaneous	47	11
Total	264	103

A random list of standards approved will show the varied character of these projects: Specifications for Portland cement; a safety code for elevators and escalators; a method of sampling coal; permissible explosives for use in mines; a code for electricity meters; a safety code for aeronautics; standard screw threads; method of testing the toughness of rock; mathematical symbols; a safety code for automobile brakes.

In this work more than 300 national organizations are coöperating. Of these about 200 are trade associations.

The Government is interested in industrial standardization, not only as a purchaser, but through its great research and service bureaus. Seven departments are officially represented on the central organization, and thirty-five different branches are represented on sectional committees.

Of special importance is the Bureau of Standards, in which the Division of Simplified Practice now constitutes a part of the newly organized Commercial Standards Group. In the past the Division and the American Engineering Standards Committee have coöperated to avoid overlap and duplication. In general the American Engineering Standards Committee has concentrated upon projects involving technical considerations, while the Division has concentrated upon such eliminations of unnecessary types and sizes of products as may be carried out solely from a consideration of past sales data. Upon the organization of the new Commercial Standards Group, the American Engineering Standards Committee has suggested corresponding arrangements to prevent duplication of effort.

National organizations corresponding to the A. E. S. C. now exist in twenty countries, including all of those countries that are most important industrially. Coöperative contact with all these has been established; and publications and data on work in progress are regularly exchanged. In fact the organization of an international federation of these national bodies for closer coöperation is under way, though there are naturally considerable difficulties in bringing about so far-reaching an undertaking.

In the specification field the work has been almost wholly limited to raw and intermediate products, or at least to those purchased in sufficient quantity to justify regular testing or inspection on the part of the purchaser in checking deliveries. Materials going into the hands of the unorganized ultimate consumer involve much more difficult problems. Nevertheless, the growing importance of the subject, combined with reaction against abuses accompanying present distribution and advertising methods have developed considerable interest in the possibilities of the control of the quality of such products purchased by the man in the

street—and his wife. For example, the American Home Economics Association has requested the A. E. S. C. to undertake the preparation of national specifications for ordinary household refrigerators, and for sheets.

There is great need of local organization in each of the principal industrial centers to assist the local industries in taking full advantage of the national standardization movement, and in facilitating the solution of their problems in aligning their work with it. Excellent progress in this activity has been made in Cleveland, and similar local organizations are now in contemplation in Chicago, Philadelphia and Pittsburgh. An important step in the same direction is the issuance of a bulletin to the entire membership of the organization, including 330 industrial concerns which are sustaining members.

Notwithstanding the very substantial accomplishments in bringing about national consensuses on more than a hundred important standards, and the progress made on 160 other projects, probably the most important service rendered by the A. E. S. C. has been in breaking ground in so difficult an undertaking—getting a real national movement organized and under way—getting thirty-six important diverse national organizations, including seven departments of the Federal Government, to undertake responsibility for the movement—securing the official coöperation of over 300 national organizations.

Yet compared to the opportunities for service to industry and to the public, only a small beginning has been made. Consider the 27,000 specifications listed in the Directory of Commodity specifications issued by the Bureau of Standards—in some cases as many as fifty different specifications for a single commodity! It is an opportunity and a challenge to service in a national problem of major economic importance.

As a concrete example of how a successful attack is being carried through in a limited field, the reader is referred to Mr. Van Schaack's paper on the national safety code movement, elsewhere in this number of *The Annals*.

The last decade has seen amazing developments in industry. These are due primarily to increasing mass production and mass distribution. In both of these, standardization is an essential factor.

The opportunities for major contributions to the national economy by the standardization movement during the next decade are immensely greater than they have been in the past. The service to be rendered is limited only by the resources of the organized movement.

How far and how rapidly these opportunities will be met must depend upon the vision and the initiative of our industrial leadership.

Canadian Engineering Standards Association

By B. Stuart McKenzie, M.E.I.C.
Secretary, Canadian Engineering Standards Association

THE Canadian Engineering Standards Association is the national standardizing body for the Dominion of Canada. It is organized for the purpose of carrying on industrial standardization, but its sphere of operations is gradually being extended to include the development of what is commonly termed simplified practice, or waste elimination. It provides the machinery by means of which various industrial interests can be brought into agreement on Canadian standards, and, as a result of such agreement, it arranges for the publication of standard specifications which it recommends to Canadian industry as good business.

History

The Canadian Engineering Standards Association was organized during the latter part of the Great War, at the suggestion of the British Board of Trade and the British Engineering Standards Association, which latter was established in 1901 as the first national standardizing body. The organization committee of the Canadian Engineering Standards Association was formed in 1917, and on January 21, 1919, the Association was granted letters patent.

Some of the objects of the Association are enumerated in the charter as follows:

1. To coördinate the efforts of producers and consumers for the improvement and standardization of engineering products.

2. To promote the general adoption of engineering standards, and to revise and amend such standards when necessary.

3. To register, use and protect distinctive marks or names as applicable to materials or products which are in accordance with standards.

4. To make arrangements with governments, or other authorities, to obtain from them privileges or concessions conducive to the objects of the Association.

5. To appoint overseas representatives of the Association.

6. To do all such other things as the Association may think conducive to the attainment of its objects.

Organization

The organization of the Association is similar to that of the British Engineering Standards Association. The work is directed by a main committee, which appoints a Chairman, two Vice-Chairmen, and an Honorary Secretary-Treasurer, these constituting the Executive Committee. The detailed work is handled by a paid Secretary and staff, with headquarters at Ottawa. Nominations for membership on the main committee are received from such bodies as the Canadian Manufacturers' Association, Canadian Electrical Association, Institution of Civil Engineers, Engineering Institute of Canada, National Research Council of Canada, Canadian Institute of Mining and Metallurgy, McGill University, University of Toronto, L'Ecole Polytechnique of Montreal, and Trades and Labour Congress. Representatives from various departments of the Dominion Government are *ex-officio* members, and other members are coöpted from railways, engineering schools, important industrial firms and

associations, and consulting engineers.

Under the main committee, sectional committees are formed, one for each branch of engineering work. Membership on these committees is approved by the main committee, which takes special care to see that representation on each committee adequately covers the particular field of engineering concerned. At present there are seven sectional committees in operation and covering civil, mechanical and electrical engineering, automotive work (including aircraft), railway work, ferrous metals and mining machinery.

Under the sectional committees the work is carried on by various committees, each dealing with some particular problem in the field covered by the sectional committee to which they report. Members of these committees are selected from the industries concerned, both manufacturers and users, with a sufficient number of technical advisers to insure a thorough study of the question involved. Membership is, as before, subject to the approval of the main committee.

With the exception of the Secretary and his staff, all the members of the Association, and members of all committees, give their services without remuneration of any kind. The Association operated until 1925 with funds provided by grant from the Department of Trade and Commerce, supplemented by subscriptions received from various industrial firms and technical organizations. In 1925, however, on account of the imperative necessity for economy, the grant from the Department of Trade and Commerce was withdrawn, and the National Research Council, realizing the importance of the work being carried on by the Association, guaranteed its budget to a certain extent, with the understanding that Canadian industry should be asked to pay its share.

METHOD OF FINANCING

For purposes of financing, the Main Committee of the Association has now been constituted the Advisory Committee on Engineering Standards of the National Research Council of Canada. An annual report of operations is made to the Council, but otherwise the work of the Association is conducted on the lines followed since incorporation.

During the period of revival in 1925 and 1926, it was not thought advisable to make any appeal to industry for financial support. In the spring of 1927, however, the Association published its first Year Book, which contains an account of the history of the Association, a description of its organization, a list of projects for which specifications have been issued, or on which committees are working, and a list of industrial firms or other organizations who have been associated with the work by the appointment of representatives on working committees of the Association.

This book was sent out to these associated industrial firms with the suggestion that they coöperate in a practical way by subscribing to the operating budget. It was felt that a straightforward appeal based on the merit of the work itself would be much more effectual than any personal endorsement. This attitude has been amply justified, and it is gratifying to report that the objective set for 1927 was exceeded, and as a matter of additional interest the majority of subscribers have indicated their intention of subscribing annually. Speaking generally, about 40 per cent of the operating budget for 1927 was subscribed by industry, the balance being taken care of by the National Research Council.

POLICY

The Association does not act as a *dictator*, but is a purely *coöperative*

body. It must be guided in its operations by the requirements of the manufacturing and industrial interests represented on its various committees. It endeavours to follow British practice as far as possible, but, on account of established business interests, it is often advisable to follow other standards which have been generally adopted in Canada. In all cases, however, the specifications prepared are drafted to meet the needs and promote the best interests of Canadian industry, and are adopted as Canadian standards.

In many quarters there has been an impression that the Association is a governmental body with power to enforce its specifications on industry. On the contrary, however, the specifications issued by the Association represent the considered thought of voluntary committees whose membership is Dominion-wide and consists of representatives from both *manufacturers and users*, together with a certain number of technical advisers. No project is ever undertaken until a definite suggestion is received from a responsible source that the initiation of the particular project will be of practical benefit to industry.

The specifications make their appeal, and their very success depends, on their inherent merit and common sense, there being no idea of compulsion whatever. Specifications are subject to revision at any time in order to keep them up to date, and suggestions for revisions are always welcomed.

INTERNATIONAL COÖPERATION

On account of its association with similar standardizing bodies in twenty different countries, the Canadian Engineering Standards Association is enabled to keep closely in touch with the standardization movement throughout the world. Coöperation with Great Britain and the United States is naturally most essential, and specifications and correspondence are freely exchanged. Representatives of the Association frequently act as observers on committees of the American Engineering Standards Committee.

Copies of the Year Book, Canadian Engineering Standards Association Bulletin, and specifications, as issued, are sent to all the national standardizing bodies. Progress reports are exchanged periodically and items of international interest in the standardization field are noted from time to time in the Bulletin.

COÖPERATION WITH INDUSTRY

It is interesting to record the progress that has been made in attaining that friendly coöperation with industrial interests which is so desirable, in fact so essential, in promoting the work of industrial standardization. Reference has already been made to the practical coöperation experienced in financing the 1927 budget, but in other ways there is a marked evidence that the Canadian Engineering Standards Association has a useful field, and that industry appreciates the fact. During the past year and a half the chairman of the Association has, on invitation, addressed the Association of Canadian Building and Construction Industries, and the secretary, by invitation also, has addressed the Canadian National Clay Products Association, the Canadian Concrete Products Association, Canadian Paint, Oil and Varnish Association, the Montreal Metal and Hardware Association, the Sheet Metal Exchange, and the Steel and Power Show recently held in Toronto.

There have been many requests for representation on the various working committees, and on the main committee of the Association. Sales of publications have become active again, and many firms and individuals have asked

that they be put on the mailing list for all publications.

ASSOCIATION ACTIVITIES

Up to 1925 the Association published eighteen specifications, but during the latter half of 1925 and the early part of 1926 the work was conducted by a part-time secretary, which arrangement was, of necessity, a serious handicap to successful operations. A permanent secretary was appointed on April 21, 1926, and since that time it has been possible to properly organize the work and inaugurate a programme of expansion.

In order to give the reader a comprehensive idea of the variety of projects which are handled, a brief review of the recent activities of the Association is given herewith.

During 1926 and 1927 four publications were issued, of which the following is a brief description:

Items of Highway Expenditure.—The Association published in March, 1926, A19–1926, Standard Classification of Items for Highway Expenditure. This provides for a uniform system of accounting in connection with highway construction contracts. It has been favourably received and has proved of great assistance to highway engineers and government and municipal officials.

Control Cable in Power Houses.—This is one of the more recent projects, and was suggested by construction and operating men engaged in the erection and equipment of power houses. C21–1927, Standard Specification for Control Cable for Electrical Power Plant Equipment was published in August, 1927, and has already been used on large orders. It represents the work done by a representative committee of cable manufacturers and power men. Its chief feature is a color code which provides for the identification of fifteen different cables by the use of not more than two colors at any one time and a uniform design in the braid covering.

Movable Bridges.—This project was brought to a successful conclusion by the publication in October, 1927, of A20–1927, Standard Specification for Movable Bridges. This is an amplification of the section on Movable Bridges which appeared in the first specification for Steel Railway Bridges in 1920, and covers requirements pertaining to movable bridges of all types.

Canadian Electrical Code.—This is perhaps the outstanding item, and the publication in October, 1927, of C22–1927, Canadian Electrical Code, Part I, covering Essential Requirements and Minimum Standards for Electrical Installations in, on, or over Buildings Using Potentials of from 0–5000 volts, was something of an event in the Canadian electrical field. The work was recommended by a special committee of the Association in 1920. In 1923 a special interprovincial conference was called by the Department of Trade and Commerce, and in 1924 a working committee of the Canadian Engineering Standards Association was organized. The draft was prepared by electrical men specially engaged for the purpose, their expenses being taken care of, for the most part, by special subscription from electrical manufacturing firms, Fire Underwriters' associations, railway companies, etc. The Code was prepared under the supervision of committees composed of representatives from nearly every province, from underwriters' associations, power companies, electrical manufacturers and contractors, telephone companies, and various departments of the Government.

This Code is based on the National Electrical Code, the National Electrical Safety Code, Rules and Regulations of the Hydro-Electric Power Commission of Ontario and other provincial or

municipal regulations. Its prime object is to promote the adoption of uniform electrical regulations throughout Canada, a condition much to be desired. A somewhat unique feature is the provision for both fire and personal safety hazard, and the inclusion of rules for resuscitation from electric shock. For the proper operation of the Code in the meantime, it will be necessary for the different provinces to pass enabling legislation in order to give the necessary authority to their respective inspection departments. It is hoped eventually to secure Dominion legislation.

The Dominion Government has announced its intention of establishing extensive research laboratories at Ottawa, in connection with which arrangements will be made for the testing and approval of electrical apparatus under Canadian Code rules and specifications.

Working committees of the Association have now under consideration the following projects, many of which it is hoped to complete during 1928:

Brick Sizes.—As a result of a discussion held at the convention of the National Clay Products Association at Toronto, in February, 1927, a conference was called by the Canadian Engineering Standards Association at Ottawa on March 18, 1927. At this conference, representatives from the manufacturers, builders, engineers, architects, labour organizations and the Dominion Government Department of Ceramics were present. A resolution approving the adoption of two standard sizes of brick was passed unanimously, these sizes being 8 in. x 3¾ in. x 2¼ in. for common and rough face and 8 in. x 3⅞ in. x 2¼ in. for smooth face brick. Manufacturers in Ontario started manufacturing brick to these sizes on October 1, 1927, and in Quebec on February 1, 1928, but there may be a slight change in the size for face brick owing to a recent suggestion from the Association of Canadian Building and Construction Industries.

Steel Bridges.—Specifications published by the Association, and covering Steel Railway and Steel Highway Bridges, have been almost uniformly adopted in Canada. Owing to the constant demand it has become necessary to prepare for a third edition of the Railway Bridge specification, and a second edition of the Highway Bridge specification. Revised drafts are now under consideration by the respective committees, and it is hoped to issue the new editions early in 1928.

Steel Buildings.—A revised edition is now being considered, one of the chief items being the raising of the unit working stress from 16,000 to 18,000 pounds per square inch for tension. This is in accord with up-to-date practice and has already been unanimously approved by the committee.

Concrete and Reinforced Concrete.—The committee has prepared a draft specification which will shortly be sent out for approval. This specification covers materials, proportions, consistency and mixing, forms and placing, waterproofing and protective treatment, surface finish and details of construction. Special attention has been paid to construction conditions prevailing in Canada.

Machine Screws.—A committee has been at work on this important project since 1926, and the main object is the preparation of data sheets on which will be shown a simplified list of machine screws which will serve every practical purpose. A list of screws was prepared by the committee, which showed that there were 43 different machine screws on the market in Canada, many of them subject to very infrequent call. The committee have decided to eliminate 25 of these screws, thus reducing

the list to 18. When this list has been approved by the committee it will be recommended for all new work. If it is adopted, there will be a distinct benefit to the manufacturer in reducing storage space, encouraging mass production and reducing manufacturing cost. This in turn will benefit the user in securing lower prices and prompt delivery from stock.

Steel Castings.—This project was suggested as a result of serious trouble experienced with castings subjected to heavy duty in service. The committee has been working on this for some time, and a draft specification is now before the members for their comment. This draft has been modelled on existing specifications, but a special section has been added which deals with heavy duty castings and covers special provisions for heat treatment and tests.

It is felt that a campaign of education is necessary so that designing engineers will be better informed on modern foundry practice, that purchasing agents will consult with their engineering department before placing orders, that inspectors will properly understand what can be reasonably demanded of the foundryman, and finally that the foundryman will appreciate the important service demanded of certain steel castings and understand the reason for the demands made by the inspector. In the preparation of this specification, the most modern foundry practice has been considered, and it is interesting to note the great advance made in the casting art during the last five years.

Cast Iron Pipe.—A draft specification has now been prepared and is before the members of the committee for criticism. There seems to be a strong feeling that special emphasis be laid on physical tests of pipe, and that after all the chemical composition of the metal is of comparatively minor importance. This view is being strongly supported by the U. S. Bureau of Standards at Washington. There seems to be every prospect of somewhat radical revisions in pipe dimensions before long, but it would seem advisable to issue a specification in the meantime for Canadian use. The specification sponsored by the Engineering Institute of Canada is out of print, and there is no Canadian specification now available.

Traffic Signals.—Final draft of specification covering this project has been before the committee for some time, but has been held up on account of the difficulty of getting uniform practice in the different provinces with special reference to warning signals on the highways. In this work the Association has kept closely in touch with the Canadian Good Roads Association. A discussion was held at an Interprovincial Road Conference held in Quebec in January, 1928, at which representatives from the various provincial highway departments, the two railways, the railway commission and the Canadian Engineering Standards Association were present, and it is hoped to come to some satisfactory agreement in the matter at an early date.

Transformers.—The committee on transformers has concentrated its efforts on a revision of C2–1920, Standard Requirements for Distribution Type Transformers. It was found that this specification was not altogether satisfactory in practice, and a certain adjustment was necessary to bring the manufacturers and users more closely together. This revised specification is now awaiting final approval by the committee. In connection with the work on power transformers, the committee is now collecting data on voltages, and although it is a very difficult problem, it is hoped to frame a specification to cover this important field. A tentative draft has been pre-

pared and has been submitted to the committee.

Steel.—Committees have been working on specifications covering Sampling for Check Analysis and for Forging Quality of Bar and Billet Steel. Drafts have been prepared and are now before the members for comment and final approval is possible. It has been the endeavour to make these specifications as clear and concise as possible, and they are framed to meet Canadian conditions.

The above review covers the more important projects which are engaging the attention of the Canadian Engineering Standards Association, but suggestions for new work are being continually received and will be taken up in due course. Among items suggested are plow bolts, cap screws, glass bottles, paper sizes and pole line hardware.

PUBLICATIONS

The following is a complete list of the specifications issued to date, and copies may be obtained from the Secretary at Ottawa at any time:

No. A1–1928	Standard Specification for Steel Railway Bridges (third edition).
A1a–1928	Material Specifications, Steel Railway Bridges (reprint).
C2–1920	Standard Requirements for Distribution Type Transformers.
C3–1924	Standard Specification for Galvanized Telegraph and Telephone Wire (reprint).
B4–1921	Standard Specification for Wire Rope for Mining, Dredging and Steam Shovel Purposes.
A5–1927	Standard Specification for Portland Cement (second edition).
A6–1922	Standard Specification for Steel Highway Bridges.
D7–1922	Standard Specification for Flexible Steel Wire Rope and Flexible Strand for Aircraft Purposes.
G8–1923	Standard General Specification for Commercial Bar Steel.
A9–1923	Standard Specifications for Reinforcing Materials for Concrete.
C10–1923	Standard Specification for Tungsten Incandescent Lamps.
D11–1924	Interim Report on the Manufacture, Testing and Use of Gasoline.
B12–1924	Standard General Specification for Galvanized Steel Wire Strand.
E13–1924	Standard Specification for Railway Wire Fencing and Gates.
C14–1924	Standard Specification for Reinforced Concrete Poles.
C15–1924	Standard Specification for Eastern Cedar Poles.
A16–1924	Standard Specification for Steel Structures for Buildings.
C17–1925	Standard Requirements for A. C. Watthour Meters.
B18–1925	Standard Specification for Stove Bolts.
A19–1926	Standard Classification of Items of Highway Expenditure.
A20–1927	Standard Specification for Movable Bridges.
C21–1927	Standard Specification for Control Cable for Electrical Power Plant Equipment.
C22–1927	Canadian Electrical Code, Part I.

A small stock of specifications issued by the British Engineering Standards Association is on file, and specifications issued by the American Engineering Standards Committee can be readily obtained. Arrangements can also be made to obtain the publications of other standardizing bodies in Europe.

In addition to the Year Book already mentioned, the Association now publishes the Canadian Engineering Standards Association Bulletin, a quarterly pamphlet giving an account of current committee meetings, announcement and description of new publications, secretary's activities, personnel of working committees, and other items of interest. Four numbers have appeared to date and have met with a most encouraging reception. Copies of the Year Book and the Bulletin are sent to those interested free of charge.

CONCLUSION

Standardization and simplification go hand in hand, and much of the work

now being done by the Canadian Engineering Standards Association is in the nature of simplified practice, or waste elimination.

Although considerable standardization work has already been done in Canada, the work of simplification is still in its infancy, and for an organization such as the Canadian Engineering Standards Association there is presented a most fruitful field of endeavour. No material progress can be made without whole-hearted and practical coöperation on the part of industry, and it is safe to say that when industry once realizes the financial benefit to be derived, there will be no lack of coöperation on their part.

It is most encouraging to report that so many representatives of industrial firms and so many technical men have shown their willingness to voluntarily give their services in the preparation of specifications already issued by the Association, and to them a great debt of gratitude is due. It is the earnest desire of the Association to establish and maintain the most friendly relation with all industrial interests and it welcomes every opportunity of assisting in the solution of industrial problems, wherever the principles of standardization and simplification can be applied.

It is impossible to overestimate the financial benefits to be derived by those who adopt and intelligently apply the principles underlying these two great economic movements. The Canadian Engineering Standards Association therefore, is not at all diffident about offering its services, and it looks hopefully to Canadian industry for the financial support and coöperation necessary to carry on its work.

Simplification and Standardization in Europe

By Victor S. Karabasz

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THE amount of work being carried on in the fields of simplification and standardization in Europe at the present time is astonishing. This work has already attained such proportions that its beneficial effects are being felt in European industry. It has been of considerable importance in the industrial rehabilitation of Europe following the war, and at the present rate of development promises to be of much greater importance in the future.

Early Stages of Development

In the early stages of the development of simplification and standardization they were regarded only as problems of interest to the technical men in the organization; now they are beginning to be regarded as managerial problems of the greatest importance in industrial production. European industrialists are beginning to realize more than ever before the important parts which simplification and standardization must play in the manufacturing development of their countries and in their ability to compete successfully in the scramble for foreign markets. Indeed, much of the work in these fields is being done with the foreign market particularly in mind.

Widespread Interest

Simplification and standardization in Europe have become a part of the very important movement of "rationalization" of industry, a movement which promises to be of tremendous importance in the industrial development of Europe. Some conception of the importance which the world at large and European nations in particular attach to simplification and standardization can be obtained from the report of the World Economic Conference, which met in Geneva from May 4 to 23, 1927. One of the questions discussed at this conference was that of the "rationalization" of industry. "Rationalization" of industry was advocated by the conference, and with regard to it the conference had the following to say:

> The first of these problems is that of rationalization, by which we understand the methods of technique and of organization designed to secure the minimum waste of either effort or material. It includes the scientific organization of labor, standardization of both material and of products, simplification of processes and improvements in the system of transport and marketing. . . . The Conference considers that such rationalization aims simultaneously:
>
> 1. At securing the maximum efficiency of labor with the minimum of effort.
> 2. At facilitating by a reduction in the variety of patterns (where such variety offers no obvious advantage) the design, manufacture, use and replacement of standardized parts.
> 3. At avoiding waste of raw materials and power.
> 4. At simplifying the distribution of goods.
> 5. At avoiding in distribution unnecessary transport, burdensome financial charges and the useless interposition of middlemen.
>
> Its judicious and constant application is calculated to secure:
>
> 1. To the community greater stability and a higher standard in the conditions of life.
> 2. To the consumer lower prices and goods more carefully adapted to general requirements.

3. To the various classes of producers higher and steadier remuneration to be equitably distributed among them.

Another indication of the widespread European interest in simplification and standardization is found in the large number of articles published in the technical magazines as well as the recent appearance of two books on the subject. In England Cecil Chisholm has published a book entitled "Simplified Practice," in which he discusses simplification as carried on in the United States as well as the possibilities of simplified practice in British industry. In Germany, Mr. B. Birnbaum, a member of the German Merchants' Delegation to the United States, has written, "The Elimination of Waste Movement in the United States," in which he stresses the work of the Division of Simplified Practice of the United States Department of Commerce.

Although there existed before the war only one national standardizing body in Europe—the British Engineering Standards Association—no less than sixteen European countries have such bodies at the present time, and there probably is not a single country in Europe which is not in some way or other carrying on work in the field of simplification and standardization. Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Great Britain, Holland, Hungary, Italy, Norway, Poland, Russia, Sweden and Switzerland have national standardizing bodies.

Table I contains the names of the national standardizing organizations.

TABLE I

AUSTRIA. Osterreichischer Normenausschuss Für Industrie und Gewerbe (O. N. I. G.), Vienna, Austria.

BELGIUM. Association Belge de Standardisation, Brussels, Belgium.

CZECHOSLOVAKIA. Ceskoslovenska Normalisacni Spolecnost, Prague, Czechoslovakia.

DENMARK. Den danske Standardiseringskommission, Copenhagen, Denmark.

FINLAND. Finlands Standardiseringskommission, Helsingfors, Finland.

FRANCE. Association Française de Normalisation, Paris, France.

GERMANY. Deutscher Normenausschuss, Berlin, Germany.

GREAT BRITAIN. British Engineering Standards Association, London, England.

HOLLAND. Central Normalisatie Bureau, The Hague, Holland.

HUNGARY. Magyar Ipari Szabvanyosito Bizottsag, Budapest, Hungary.

ITALY. Comitato Generale per l'Unificazione nell' Industria Meccanica, Milano, Italy.

NORWAY. Norges Industriforbunds Standardiseringskontor, Oslo, Norway.

POLAND. Polski Komitet Normalizacyjny, Warsaw, Poland.

RUSSIA. Council for Labour and Defense, Standards Committee, Moscow, U. S. S. R.

SWEDEN. Svenska Industriens Standardiseringskommission, Stockholm, Sweden.

SWITZERLAND. Schweizerische Normalien-Vereinigung, Baden, Switzerland.

While all European countries having national standardization organizations are doing important and valuable work, the work of Germany and Great Britain is of outstanding importance and is worthy of considerable study.

GERMANY

Standardization work on a national scale began in Germany in May, 1917, with the organization of the Normalienausschuss für den Maschinenbau. This organization was charged with the responsibility of standardizing fundamental machine elements. The work of this organization developed so rapidly, extending itself to other industries, that in December, 1917, it was decided to change the name of the organization to Normenausschuss der Deutschen Industrie. The organiza-

tion operated under this name until November, 1926, when it was again decided that the name of the organization did not properly describe the work as it had been rapidly developing since 1917, and the name was, therefore, changed to "Deuscher Normenausschuss." This organization is now the national standardizing body of Germany.

Deutscher Normenausschuss is supported in part by an appropriation from the Reichs Kuratorium für Wirtschaftlichkeit, which is an organization supported by government grants, the purpose of which is to act as a clearing house of information of value to German industry as well as to act as the center of the Rationalization movement in Germany. Deutscher Normenausschuss is also supported by technical societies, trade associations and a large number of individual firms. In fact Deutscher Normenausschuss is a federation of technical societies, trade associations, government departments and contributing industrial firms, developing nationally recognized industrial standards.

As is the case in the development of standards in nearly all countries, the Deutscher Normenausschuss operates on a committee basis on which committees are represented, all the parties interested in the development of a given standard. The liberal representation of all the interested parties on the various working committees and the widespread publication of the tentative drafts for criticism assures adoption of the standard after it has been established by the committee.

Practically all of the large and medium-sized firms in Germany are taking an active part in the development of standards. Some of these firms have their own standardization organizations, and the profession of standardization engineer is already established and is being rapidly developed. Some consulting engineering firms specialize in standardization work, while a fair proportion of the time of others is being devoted to this work. In many concerns the use of parts or material other than the regularly established standards must be specially authorized, while others have all drawings carefully checked to see that the maximum use is being made of the established standards.

Some conception of the widespread character of the work being carried on in Germany can be obtained when one understands that in the period of ten years the Germans have developed and established more than 2100 standards, and these standards embrace nearly every branch of industry. Up to the end of 1919 the number of standards established was 24; in 1920 it had increased to 102, in 1921 to 242; in 1922 to 335; in 1923 to 571; in 1924 to 748; in 1925 to 1235; in 1926 to 1709, and in 1927 to 2129.

Important work in simplification and standardization is now being carried on in the agricultural implement, enamel ware, file, tool, aluminum, textile, leather, oil, building, varnish, ink, bicycle, brush and other industries.

In order to bring the established German standards into general use as quickly as possible, a number of important German firms, including the Allgemeine Elektricitäts Gesellschaft, the Süddeutsche Metallindustrie, the Hirsch Copper and Brass Works and others have declared that they will not charge up to buyers of standardized goods and spare parts the cost of introducing new tools for the manufacture of standard articles.

The outstanding characteristic of German standardization, in addition to the large number of standards established, is that the vast majority

of it is dimensional work with relatively less emphasis on quality specifications and tests.

GREAT BRITAIN

Simplification and standardization work in Great Britain while progressing at a slower rate of speed than in either Germany or the United States, nevertheless has made notable advances and is worthy of special notice.

The national standardizing body in Great Britain is the British Engineering Standards Association. It was established in 1901. Its budget is about $80,000 per year, and receives financial support from the British Colonies and Dominions, as well as from industry. This organization has very nearly 500 committees and subcommittees working on various phases of standardization and simplification in a great variety of industries. In this work thousands of business men and engineers contribute their services without fee.

Considerably more than 500 standard specifications have been issued up to the present time. These standards are published and sold to all interested. Over 50,000 copies of such standards are sold annually.

The procedure in the developing of programs of standardization and simplification in Great Britain is almost identical to that used in the United States, with the exception that there is no organization in Great Britain corresponding to the Division of Simplified Practice of the United States Department of Commerce to facilitate the work of simplification. This is a distinct handicap to those industries which might be classified as non-technical.

It is interesting to note the emphasis which is placed upon the foreign trade possibilities in a given program of simplification and standardization in Great Britain. An excellent example of this is found in the program of simplification of steel telegraph poles, in which the number of telegraph poles was reduced from almost an infinite variety to four. Each of the four varieties retained is different and the four varieties provide a pole for any possible variation in climate. These types, when finally issued, will not only be a standard for England but will, in reality, be Empire standards.

Another interesting feature of British standardization is that a considerable sum of money has been appropriated in order to have the existing British standards translated into foreign languages, so that they can be used by foreign purchasers and thus increase the market for British goods.

Out of a list of more than 250 standards which were in the course of preparation in 1927 by the British Engineering Standards Association, the following were chosen at random and will give some indication of the type being worked upon:

Structural Steel for Shipbuilding
Cast Iron Pipes for Water Gas and Sewage
Broken Stone for Road Purposes
Details of Locomotive Construction
Carriage and Wagon Axles
Rivets for Boilers
Twist Drills
Fire Hose Couplings
Steam Turbines
Electrical Performance of Traction Motors
Edison Screw Lampholders and Caps
Electric Cut-outs
Insulating Oils
Deck and Hatch Fittings
Grey Iron Castings
Hard Pure Aluminum Sheets for General Engineering Purposes
Brass Aluminum and Copper Rivets for Chassis
Meshes and Gauges of Screen Material
Patent Liquid Driers
Colliery Tub Wheels and Axles
Mining Hand Lamp Bulbs

FRANCE

Association Française de Normalisation, the national standardization body of France, was founded by a Presidential Decree on June 10, 1918. It is attached directly to the Ministry of Commerce and among its members are included the Departments of Commerce, War, Naval Affairs, Public Works and Labor. The Academy of Science, the Society for the Encouragement of National Industry, the Society of Civil Engineers, the Society of Electrical Engineers, the Society of Mining Engineers, as well as many other technical societies, are associated with it.

There has been, and continues to be, a considerable amount of interest in simplification and standardization. At the present time special emphasis is being placed upon its application in the automobile and automobile accessory industries. The two organizations interested in the development of standards in these industries are the French Society of Automobile Engineers and the Association of Manufacturers of Automobile Accessories. The fact that a certain manufacturer of piston rings carried no less than 3800 models, that there are at least 250 types of batteries and 60 dimensions of tires is some indication of the work ahead of these organizations.

The organizations interested in the development of standardization in France have, up to November 30, 1927, established approximately 350 standards. The Permanent Committee on Standards has adopted 50; the Union of Electricity Syndicates 40; the Technical and Industrial Department for Aviation, 60; the Association of Railway and Tramway Builders, the Union of Railways, the French Mining Committee and other organizations have adopted about 200.

CZECHOSLOVAKIA

In Czechoslovakia there exists the Czechoslovak Society for Standardization. This society was founded in 1922 by twelve leading industrial establishments, and had, at the end of 1927, sixty-nine members. Membership is limited to industrial establishments.

By the end of 1927, twenty-six Czechoslovak standards were published in book form in both Czech and in German, and sixty other standards were in the course of preparation.

As an illustration of the type of work being carried on in Czechoslovakia, it can be stated that the number of sizes of wagon wheels were reduced from 1000 to 28, and that 200 different types of frames for doors and windows have been reduced to 16 standard types.

The Masaryk Academy is a very important organization in Czechoslovakia, fostering the development of industrial management and making known to the engineering and industrial community the necessity for simplification and standardization.

ITALY

In Italy excellent work is being done by the national body, Comitato Generale per l'Unificazione nell' Industria Meccanica.

POLAND

In Poland the Polski Komitet Normalizacyjny is doing excellent work in simplification and standardization, and the results of this fine work are evident in Polish industry. The Institute of Scientific Management (Instytut Naukowej Organizacji), Warsaw, under the very able direction of Professor Adamiecki, is doing very valuable work in fostering simplification and standardization in Poland.

AUSTRIA

The Austrian standardization work is much like that of Germany. There is an active national standardizing body in Austria whose work is well worth studying.

HUNGARY

Hungary possesses a very active national body, the Hungarian Engineering Standards Committee, which was established in 1921. Some very interesting work is being carried on in connection with the development of standards relating to mining equipment and mining practice, as well as to standard classifications of coals.

NORWAY, SWEDEN AND DENMARK

Norway, Sweden and Denmark have national standardizing bodies which are actively engaged in the development of standards for their respective countries.

BELGIUM

The standardization work of Belgium probably resembles that of England more than that of any of the other continental countries.

SWITZERLAND

A very large amount of standardization work under a very active national organization is being carried on in Switzerland.

THE NETHERLANDS

The national standardizing body of the Netherlands have more than one hundred projects under way at the present time. Some of the programs being worked upon are those covering portland cement, cement lime, conduit pipes and accessories, fire service material, nuts and bolts, ball bearings, electrical machines, ship building and pulp.

SOVIET RUSSIA

A tremendous amount of interest in simplification and standardization is being shown in Soviet Russia. The Standards Committee of the Council for Labor and Defense, the national standardizing body of Soviet Russia reported on January 1, 1927, that at that time approximately 400 standards were in various stages of development. These standards are classified into fourteen main groups, namely: Fuel, Agriculture, Foodstuffs, Metals, Electrical Engineering, Chemical Industry, Textile Industry, Leather and Furs, Paper, Woodworking, Civil Engineering, Transport, Communications and General.

Russia is gathering from the United States and other countries all of the available established standards which she is using in the development of her own standardization programs. Such organizations as the Institute of Administrative Technique in Moscow, and the Institute for Scientific Management in Kazan and others, are taking an active part in educating the various interested groups in the value of simplification and standardization.

OUTSTANDING GROWTH

The growth of simplification and standardization in Europe since the war is nothing short of marvelous, not only from the standpoint of the number of standards actually established and the number in the course of preparation, but also from the standpoint of the number of industries involved and the high quality of the work being performed. This tremendous growth is in part the result of the industrial conditions in which most European countries found themselves at the end of the war; in part to the fact that simplification and standardization have become part of the important "rationalization" movement in Europe, a movement

which considers both these problems of fundamental importance in the industrial development of an individual country and of Europe generally; in part to the realization that simplification and standardization have an important bearing on foreign trade; in part to the general use by European countries of the "sectional committee" idea developed by the British in the development of standards which practically assures the utilization of the standard after it has been once adopted; and in part to the use by many European countries of such publications as the DIN Mitteilungen des Deutschen Normenausschusses, publications which keep industry informed on the progress being made in standardization throughout the country.

The two most active countries in Europe in the field of simplification and standardization are Germany and Great Britain. The work being carried on by Great Britain more nearly corresponds to that being done in the United States, while that of Germany, up to the present time, has been primarily dimensional in character. The work of the other European countries is by no means, however, to be ignored. It, together with that of Germany and Great Britain, is worthy of careful study by United States manufacturers.

The Place of Standardization in Modern Life

By Albert W. Whitney

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IT is not uncommon nowadays to see articles and editorials and letters in the public press deploring the state of uniform mediocrity that standardization will produce if allowed to have its way; this may even be considered to be a standard objection to standardization; in fact, with fine irony, a syndicated editorial on the evils of standardization has recently appeared in papers throughout the country.

That the question is receiving public attention indicates two things: First, that standardization is now generally recognized to be a matter of importance, and second, that either a real danger exists or else a popular misapprehension of what standardization aims to accomplish. In any case the situation calls for light and discussion.

Business and industry must increasingly feel an obligation to discover the social implications in what they are doing. It is not enough to justify an institution merely by its effect upon business, for business, the supplying of the material needs of the world, must look for its own justification to its effects upon society. The place of standardization must therefore be judged from this broader, more thoroughly human point of view.

The questions that must be considered are these: Is standardization a desirable and necessary process; if so, what is its exact place in the world; and second, how is it susceptible of abuse, and how can such abuse be avoided? In order to answer the first and main question it will be enlightening to realize the part that standardization has played in nature.

The Part of Standardization in Nature

The processes of nature and of men, are, after all, very much alike. The designing room of nature is continually turning out new ideas in plant and animal life. These she tries out, not on a special testing floor, but in life itself. If they are worth while, the new forms find a place for themselves and live; if they are badly designed, they die and leave no descendents and the model is discontinued.

The advance that man has made, building upon all that nature can give, lies in the ability to experiment. He does not have to wait for the slow process of mutation and for an actual trial in life itself. Thought consists essentially in the ability to try the world out in imagination. The architect's plan for a house is essentially his way of being able to live in imagination in the house, and if in this imaginary life he finds that there are no stairs to the attic and that he has an inconvenient time getting a bath, it is not necessary to tear the house to pieces in order to make the correction, but only to do some more thinking. All thought, even the most abstract, is essentially a way of imagining life.

There should be then a strong resemblance between the processes of nature and the processes of man, the difference being that nature works through the infinitely slow method of trial and error and deals with life itself while man works largely in a thought world and in the laboratory which, while one stage nearer, is still far short of being actual life. All this being so,

the part that standardization has played in nature should give us a very excellent idea of the part that standardization can play and should play in the world of human activity.

Nature, by some innate property of germ plasm, stimulated apparently by the varying conditions of the environment is perpetually creating new variations in plant and animal life. This is precisely analogous to the creative faculty in human thought. This process of nature, uncontrolled, would fill the world with endless variety. There would be not only the myriad types that we now have but innumerable modifications of those types. Natural selection, however, acting upon this variety, has had the effect not only of choosing certain types as worthy to survive but of endowing those types with a certain degree of permanence and stability and isolation. It is as though nature had not only given each type a chance to survive but had gone further and cleared out the weeds near by so as to give it the best possible opportunity to get light and air.

The effect is that nature, instead of filling the world with a continuum of plants and animals, has filled it with a discrete and actually enumerable assemblage of types, and furthermore, an ordered assemblage, each of which has a considerable degree of stability and among which certain type-conserving forces operate such as those that inhibit miscegenation.

Now this establishment of a system of discrete and enumerable types in nature is the exact analogue of standardization as a purposeful human activity, and the two are subject to the same laws and to the same abuses.

Not only has nature developed types which can be enumerated and classified, but she has standardized for each a multitude of organs and functions. Individuals of the same species resemble each other in the minutest details of structure and function. If this were not so, organized life would be practically impossible. Everything would be an individual problem with no possibility of generalizations. Institutions and customs would be impossible, for institutions and customs and laws depend upon an underlying sameness of reaction. There could be no medicine, for there would be no uniformity of physical organization or response; there could be no surgery, for the surgeon would not know whether he were cutting into a heart or a liver; there could be no organized education, because each mind would be an educational problem by itself. An underlying sameness is the basis for every civilization.

VARIETY AND INDIVIDUALITY

I do not overlook the fact that with this sameness goes along a strong flavor of variety and individuality. No two faces are exactly alike and no two temperaments and personalities are exactly alike, but this very difference, which undoubtedly gives not only much of the charm to life but which is as well the cutting edge of progress, can flourish only on a deep-lying basis of uniformity. It is the differences that persist, some of them racial but many of them cutting across racial lines, that account for the actual diversity of civilizations and institutions. Thanks be for the diversity but, still more deeply, thanks be for the sameness that makes the diversity possible and effective.

There are, then, in nature these two fundamentally different tendencies: First, a force that is continually operating to produce greater variety and, second, a force that is continually operating to eliminate unsuccessful variations and to concentrate upon relatively few types which in their main

features are reproduced faithfully from generation to generation.

VARIATION VS. STANDARDIZATION

Now, both of these processes are absolutely necessary in a world of progress and each depends intimately upon the other. Variation is creative, it pioneers the advance; standardization is conservational, it seizes the advance and establishes it as an actual concrete fact. Variation is primarily concerned with quality, standardization is primarily concerned with quantity, that is, with mass production. If the world were broken up into an innumerable number of forms with no rallying points at which nature had carried on mass production, there would be no way of expressing the fact that the successful type had been discovered. In order to make progress not only must there be a better type, but it must be made the prevailing type. If nature had no mechanism for fixing and holding the type, she would have no way of capitalizing her discoveries. Furthermore, there would be no adequate basis from which to spring in order to make the next advance. Variation is the active, creative, masculine force in evolution; standardization is the passive, brooding, conservational, feminine force out of which comes the potency of the next advance.

A SELECTIVE AND CONSERVATIONAL FORCE

When we come to the directed, purposeful evolution of human society the main lines are the same. Creation is here essentially variation from normal. Poincaré has even ventured the thought that creation, carried on as it is largely in the subconscious, may be fundamentally fortuitous, the most actively creative mind being that one which is able most quickly and most surely to run through all possible combinations of the elements of the problem and to appropriate those that have value. It is as though the mind were a shaker of dice, the most creative mind being the one that shakes the dice most eagerly and is most clever in seizing the winning combination. Standardization is here as in nature the selective and conservational force, the selection being made consciously, however, instead of through trial and error, although even in human standardization actual experiment has a large part to play.

When the type has been thus selected, economic facts fortify the selection by directing the forces of mass production upon it and it assumes a place much analogous to that of a species in the world of nature. So, just as in nature, standardization operates to capitalize the advance by making it an actually prevailing type.

EVALUATION

It is this effect that is commonly in mind when the attempt is made to evaluate the place of standardization in civilization. It is measured in terms of its effect upon mass production, it is evaluated as an instrument for making the advantages of life more abundantly available; and the critics of standardization also attack it at exactly this point, claiming that its effect is coarsening since its results are to be measured in terms of quantity rather than quality. They conceive of standardization as producing a world of universal, dull mediocrity in place of the world of color and scintillating lights and shadows and heights and depths that we have under the play of individual initiative.

While such adverse effects if produced will be largely due to the unwise use of standardization, it is also quite

necessary and pertinent to say that such criticisms completely overlook another and equally important effect of standardization that is quite wholly on the other side of the balance. I refer to the effect of standardization as liberator rather than conservator.

STANDARDIZATION AS LIBERATOR

Suppose the world of living nature really had the properties of a continuum; it would be a world of complete individualism; there would be no foci about which to group mass action, about which to gather the integrating and ameliorating forces of affection and loyalty. It would be a mad, restless, wearying world of infinite but meaningless variety and detail, obeying no laws except the laws of probability, to which even the molecules in their aimless wanderings give allegiance.

Creative work in such a world as this would be an impossibility. Nothing would stay put; there would be nothing to stand on to make a fresh advance. All one's energies would be used up in meeting the idiosyncrasies of the immediate moment. In the field of industry each piece of machinery would be an individual problem, even each screw, each bolt, and each nut. What time would be left over amid such maddening detail for fresh advances?

Standardization is thus the liberator that relegates the problems that have been already solved to their proper place, namely, to the field of routine, and leaves the creative faculties free for the problems that are still unsolved. Standardization from this point of view is thus an indispensable ally of the creative genius.

Nature has very well understood the necessities of the situation. She has not only provided the brain with which to solve new problems but she has provided the reflex nervous centers to which the brain may relegate the control of habits, which are only the clerical assistants of thoughts, so that the brain may be set free for a more primitive contact with reality. Standardization is similarly the habit-forming process in industry.

I have referred specifically to standardization as having to do with types of plants and animals and also to the industrial standardization that we are familiar with, but in passing I should call attention to the fact that standardization has a still wider scope. In a very real sense all the conservational forces of civilization are within the field of standardization, institutions, customs, laws, literature and other forms of art, science—they all involve the fixation of advances which have been made into a better understanding of the world, and such advances are in turn points from which to make fresh advances.

So far I have been concerned solely with what might be called the hygiene of standardization; that is, with evaluating the place that it should play in the world under normal conditions. This is a far easier task than to treat the pathology of standardization, that is, how it may be abused in a world that is itself more or less out of joint.

THE PATHOLOGY OF STANDARDIZATION

Standardization undoubtedly has its diseases; it would be strange if it did not. It is curious that nature itself has misused it. Nature, having discovered the type, proceeds to produce replicas in incredible numbers; the way in which babies, guinea pigs, grasshoppers, and dandelions appear in the world beats any feat of industrial mass production. And often such production of nature is quite unsuited to actual conditions or is productive of positive harm, as when a small apple tree produces so many apples that not only are they of inferior quality but

they are produced at a sacrifice to the vitality of the tree.

Standardization itself is so thoroughly fundamental and necessary a process in both nature and civilization that any evil effects must evidently be looked for not in the process itself, but in the way that it has been applied. It is probable that all abuse of standardization comes from directing it toward too limited an objective. It is either used to accomplish some immediate purpose, overlooking the larger and fuller good that might be accomplished if a longer view into the future were taken, or it is used to meet the needs not of the public as a whole, but of some particular interest. Nature, when she let the apple tree overload itself, allowed herself to be unduly concerned with the danger of the world's running out of apple trees in the next generation, overlooking not only the need of keeping the trees she already had, but the need of good apples for the present generation. She erred in this particular case by being too farsighted. We commonly err on the other side by aiming at an increase in our immediate material production, when this can be had only by the sacrifice of greater ultimate values.

SOCIAL IMPLICATIONS

At this point some consideration should be given to the social implications that are contained in the industrial standardization methods of today. In a suggestive posthumous article in the *Atlantic Monthly* several years ago, Lord Moulton commented upon the fact that law and manners and custom are only the various means that society uses to produce the degree of uniformity that is necessary as a basis for civilized life.

Custom and manners govern that part of the field in which the consequences of a departure from the established order will not be so flagrant that the situation cannot be controlled, and best controlled, through the force of public opinion. The common law covers another part of the field where an order established by long usage has finally received the sanction of the state. Statute law is a body of uniform procedure that can be enlarged quickly to meet conditions arising so suddenly that there is no time for manners and custom and common law to grow up to meet the situation.

SUSCEPTIBLE OF ABUSE

The enormous material development of the last fifty years, in which thousands of new adjustments have become necessary in fields which had never even existed before, has, however, put a load upon statute law that has proved to be unbearable. Some ten thousand or more new laws are being passed in this country each year and the courts are clogged with cases in which these laws are being interpreted.

This is not the only difficulty, however. The system of statute law is based upon the assumption that means will be found by which the laws that are made can be the product of mature deliberation by persons qualified both by knowledge and by ability and because of their representative character to decide what course of uniform procedure is in the interests of the public good. How far from this ideal is our average lawmaking of today! Our laws are in general drafted hurriedly, often or even usually by persons with very special interests at stake; they are given cursory consideration in committee by persons far from expert in the matters in question, voted upon by legislators neither representative of the interests concerned nor especially qualified to pass upon the merits of the particular measures proposed and largely influenced by political expedi-

ency. What a travesty upon the mature wisdom that is necessary in the enormously important work of establishing that basis of uniformity upon which the further progress of the race is to be built! The promise of an escape from this condition curiously enough comes not from society in general but from industry. Society with its more vital and fundamental interests is, nevertheless, extremely long-suffering. Industry's more immediate material needs are in effect more compelling, and industry has blazed a way for meeting the situation which may have far-reaching results.

REMEDY OF ABUSE

Industry was not able to depend upon legislation and the courts to make the adjustments that were necessary among the multitude of conflicting interests that required harmonization. It was driven by the exigencies of the situation to set up a machinery of its own for establishing the uniformity that was necessary for an effective carrying on of its undertakings. What was needed was a modern substitute for custom and common law, a process that would produce a thorough harmonization of interests but in a limited period of time,—kiln-dried custom so to speak.

For this purpose there were two essentials: a standard to have the same effect as custom and common law must be the product of a meeting of minds in which all interests are represented and out of which comes a genuine consensus, not the coercion of a minority by a majority.

The further we progress on the road of industrial standardization, from standardization by the individual worker to standardization by the factory, from standardization by the factory to standardization by the industry, from standardization by the industry to standardization for all industries on a national basis, the more clear does it become that standardization must be a process by which a consensus of all interests is reached in a thoroughly representative and democratic manner. Nothing else has permanent value; but when standards are prepared in this way we are made to know that we are on the right road by what has always been the sign to those that have kept the faith, a miracle.

When diverse elements are brought together, the result may be a compromise; it often is a compromise, particularly if the result is reached through the efforts of those who do not understand and who make no effort to understand, but when a body of sincere, well-meaning, understanding persons come together in the continuing presence of the truth, however diverse their interests may apparently be, a marvelous thing happens,—a solution appears which is not a compromise, but which in the majority of cases is the best for all concerned.

A standard made under these conditions has all the validity of custom and the common law itself. Having been made through a consensus of all interests concerned, it goes into effect almost automatically, for there is no one to oppose it; the problem of enforcement and administration is therefore reduced to a minimum.

The process of standardization that I have described is far more effective than the process of legislation in securing an intelligent basis of uniformity in at least two further respects: First, many standardization projects can be carried on simultaneously, for each, even though participated in by the same interests, makes use of its own particular body of experts; and, second, the very fact that the result reached is a consensus thoroughly representative of the interests involved as well as a

consensus arrived at by experts guarantees that a degree of understanding will be brought to bear upon the problem that can be had in the case of legislation only when the work is carried on by a commission.

There seems to be no valid reason why this essentially modern method of creating the equivalent of custom and common law through conference, a method which is now working so admirably over a considerable area in the industrial field, should not be extended into the broader field of social relations even though the latter problem is undoubtedly far more difficult. A consensus of all interests, arrived at through conference, seems a both reasonable and feasible substitute not only for blind competition but to a considerable extent for processes of legislation that have now proved themselves inadequate.

There can be little to fear from standards that have been made in this way. It is not the real standards that we need be afraid of. If they are right they will find a place for themselves in civilization and will only go toward building up that great wholesome, restful sameness which is the real basis not only for a democracy but for an aristocracy and the only basis upon which new growth can take place. It is the standards that do not represent a real consensus of all those interests that are concerned in progress which we should fear.

The safeguards against bringing such ill-begotten standardization into the world can only be a realization of the high and serious mission of the standardizer, and an almost religious consecration to the duty and privilege of helping to direct progress in this fundamental way.

The Economic Aspects of Standardization

By K. H. Condit
Editor, American Machinist

FROM the practical point of view there is but one criterion by which to judge a piece of industrial standardization and that is its economic justification. Much of the effort expended on standardizing in the past has been wasted because there was no economic justification for the project. The results, therefore, were not accepted by industry and the standard was not worth the paper on which it was written.

One of the factors involved in determining the economic value of a standard is its timeliness. Disregard of this factor has brought many a bit of valuable engineering standardization to grief. Take as an example one of our best instances of standardization work, the modern automobile. Today the gear-shifting arrangements on practically all cars are alike; the crankshafts all rotate in the same direction; many minor parts are interchangeable on cars of different makes but of approximately the same size. We take all this as a matter of course now, but it is only recently that it has been made possible. Consider, for a moment, what would have happened had similar standardization been attempted in 1903, only 25 years ago. The automobile then was in its early development stages. Most of the designs were experimental and were subject to radical changes each year, and sometimes oftener. Any effort to standardize then would have resulted either in failure or in a retarding of development quite as bad. Now that the art has reached a high state of advancement, annual changes are relatively minor in character, and many parts, bolts and nuts, for instance, are not affected at all. At this stage considerable standardization is not only possible but highly desirable.

Style Factor

Another factor that has a strong bearing on the economic justification of standards work is the style factor. Much of the opposition to any kind of standardization comes from generally unthinking "individualists" who view with the utmost alarm the possibility that they will be compelled by a grim-jawed, mechanically efficient standardizer to wear clothes cut to a standard pattern, made of a standard material and indistinguishable from those worn by everyone else. They fear that they will be forced to eat standardized food, drink standardized drinks and live in standardized houses. They forget that they go to work over standardized railroads, read standardized newspapers to learn what is happening in the world, and carry on their businesses with such highly standardized equipment as the telephone and the typewriter.

The distinction between what should be standardized and what should not must be made on an economic basis. As to clothes there is a definite limit. A man's coat is pretty well standardized as to general shape, arrangement of pockets and number of buttons, but not as to material or the finer points of the cutter's art. His wife's clothes, on the contrary, are apparently standard only in the distance her skirt must be from the floor. On this point the dictators of style are positive, although they revise the standard periodically. He may have a feeling when he is

presented with a bill for what seems like an inordinate number of costumes that a little standardization might be very well justified on economic grounds, but he realizes that peace of mind is also worth a lot.

At the same time, there is probably more standardization here than some of us realize. For example, one clothing maker in New York makes nothing but blue serge suits of one weight of material. There is always a market for a staple of this nature and he can therefore keep his plant working steadily and turn out a good product at a price very much below that possible for the maker who works up all kinds of goods in a variety of styles.

Here is the point overlooked by the thoughtless worrier. If the standardization he fears does not meet with general approval—if people will not buy such standardized goods—the whole attempt is a failure. It is not justified economically.

Up to this point we have discussed standardization in general terms; now we can particularize. Standardization has various stages or grades, each one of which has economic aspects peculiar to itself. The grades might be designated as international, national, industry, corporation and company.

INTERNATIONAL STANDARDIZATION

Very little has been accomplished in international standardization, for obvious reasons. The manufacturing arts are at different stages in different countries, and what is acceptable in the advanced country is not in the backward one.

Size standardization is almost impossible because of variations in measuring units. The great bulk of the manufacturing is done in Great Britain and the United States to English units, while the minor part is done in many other countries to metric units. A little progress has been made with ball bearings and screw threads.

No such serious handicap affects the standardization of test codes on an international basis. Considerable progress has been made in this direction and the machinery is set up to continue it.

Until international trade is conducted on a basis less strongly flavored with nationalism, and industrial education has made more progress than it has as yet, there will apparently be little economic justification for extensive standardization.

NATIONAL STANDARDIZATION

Coming down to the next grade, national standardization, we find fewer handicaps to be overcome. Size standardization becomes feasible by reason of standardization of the system of measures in each country. The various industries in any particular country are more nearly abreast of each other in their respective states of development, but there is still much to be desired in this direction.

Economic justification of standards work in a given country depends on the public acceptance of the work of the various organizations engaged in standardizing, and this again depends on the extent to which the general public is ready to discard tradition and accept innovation. Education and persuasion must be employed to encourage adoption of any type of standard because there is no satisfactory means of enforcing adoption. The emphasis here is on the word "satisfactory" because legislation can be employed as a means. That it is not universally satisfactory as a medium is clear from the difficulties encountered in enforcing prohibition legislation, an unpopular enactment.

What success in national standardization has been achieved in this country, and it is considerable, has been the

result of a gathering of those interested, under the direction of an impartial chairman, at which concessions were made and a general agreement was reached. Those concerned in such a meeting had a mutual interest in the undertaking and were seeking the same objective. It should be said that the standards so arrived at have been of little moment to the consumer except to reduce the cost to him of the product standardized. Because he suffered no inconvenience and has enjoyed an improvement in quality of product or a decrease in price, he has been willing to accept such standards and so assure their economic justification.

INDUSTRIAL STANDARDIZATION

Stepping now into the wider circle of industry standardization we find a smaller group of interested individuals or organizations and a correspondingly simpler task of reconciling differences. Under present conditions the trade association is the medium through which such standardization is generally accomplished. Projects not subject to national standardization because of the disaffection of certain groups or industries are readily handled in the other groups as individual actions. The result is not the perfect one that might come from a national movement but it is a step in the right direction and represents a saving for some part, at least, of industry and the consuming public.

Industry standardization sometimes fails because two or three reactionary companies or individuals refuse to come along with the majority. In that case it is perfectly possible for a large corporation in the industry to carry on its own standardization work. Perhaps the most notable example is the General Motors Corporation. It has an efficient standards committee and can point with pride to its accomplishments. Although it is extremely difficult to show savings due to standardization in dollars and cents, the tremendous profits of the corporation are attributable, in some part at least, to savings resulting from standardization.

Even in this type of standards work there are differences of opinion to be ironed out. There are many companies in the General Motors organization, and some of the individuals involved have had to be talked into acceptance of the corporation standards.

If all else fails, the individual company can always do standardizing within itself that will be economically justified on its balance sheet. There is a New England manufacturer of thread who endeavored unsuccessfully for three years to get his competitors together on a simplification project that would have saved all of them much money. At last, in disgust, he gave it up and attacked his own list of types and sizes, cutting out the small sellers ruthlessly. At present he is the only manufacturer in the group that is operating profitably. Clearly there is economic justification for this kind of standardization.

In the discussion of international standardization two kinds of standards were mentioned, test code or procedure standardization, and dimensional standardization. There is a third, quality standardization. What, briefly, are the economic aspects of these three types of standards?

QUALITY STANDARDIZATION

When we buy a boiler built to pass the tests prescribed in the Boiler Test Code we know what pressure it will stand and what to expect from it. Similarly, when we buy an electric motor we know it will stand certain conditions of service satisfactorily or we can return it. A building must comply with the local building code, from which we are certain what loads

it will carry. Buying under these conditions we are relieved from the expense of testing the product or structure for ourselves. It is safe for our men to work with, near, or in such products or structures. We are saved certain expenses that we should have to meet were the items not built according to standard code.

Quality specifications are well established and economically essential to industry. In certain cases materials are bought on the trade name only, largely because the manufacturer has built up so high a reputation for quality that checking him up has been found unnecessary. The trend, however, is toward purchase to a rigid specification to be sure that variations in materials will not upset the fine balance of operations in the modern manufacturing plant. Part of the economic justification lies in the freedom from disorganizing uncertainty. A larger part lies in the ability to purchase a standard material in larger quantities.

DIMENSIONAL STANDARDIZATION

Dimensional standards have been reduced to exceedingly close limits of recent years. Accuracy of manufacture that would have been prohibitively expensive not long ago is common practice now and has been made possible, to a large extent, by the large demand for a uniform product, thus permitting the employment of expensive special machinery. Interchangeable manufacture is founded on dimensional standardization, and is the keystone in the arch of modern industrial production. Its economic justification is obvious.

ECONOMIC STANDARDIZATION

In conclusion let us consider one other economic aspect of standardization. Any form of standard that is so rigid as to resist revision and improvement successfully is not economically sound. Such a standard deserves every bit of the suspicion with which standards in general are viewed by some people. A standard must represent the best that industry has to offer and it must persist as a standard only until something better has been proved feasible. Then it must yield its place to the improvement.

Standards that cannot readily be revised will be dealt with harshly by economic laws. They had better not have been established in the first place because their fall is likely to pull down useful structures along with them. Evidently, therefore, the economic aspect of an industrial standard is the critical one in its existence.

The Effect on Labor of the New Standardization Programs of American Industry

By William Green
President, American Federation of Labor

STANDARDIZATION is an outstanding characteristic of the present age. Standardization sets up fixed procedures or patterns as a substitute for individual discretion or fancy. Since individuals and products increasingly conform to such standard practices, they may move or be moved from place to place and fit into local activities and be used with the maximum of ease and the minimum of waste. In the industrial field programs of standardization serve to eliminate waste and to establish definite bases for contracts. Labor benefits through whatever makes for more economical production because less of the income of industry is spent in liquidating losses.

There are two main divisions in our industrial standardization program: one, industry wide, known as simplified practices, is an agreement by the members of the trade association for industry to limit production to types and styles agreed upon; and the other is the standardization of production process within a plant, known as mass production.

The Key to Mass Production

Standardization is the key to mass production which begins with standardized design and assumes standardization of all of the parts so that they may be assembled and fitted together into a completed product. Standardization means that workers instead of making complete products, make only a part and repeat that process continually. Usually a machine handles the material and the worker operates the machine. This standardization of process increases output and decreases unit costs of production.

Large scale production, even if it is not mass production, finds it necessary to have central control and many of the methods of standardization. Standardization and mass production have revolutionized industry which had prided itself in the hand-craft skills. The older industries turned out the products each of which was the work of individuals. Present day industry turns out the products which are the work of groups. Skill in using a machine replaces hand manipulation skill. Group unity in the whole process of production takes the place of individual resourcefulness.

These standardization developments have brought about for Labor the following fundamental problems:

1. How to meet displacement of workers because of increased productivity or because of seasonal fluctuations in demand.
2. How to keep workers' purchasing power growing in proportion to increased productivity.
3. How to develop vocational education methods to meet new industrial conditions.

Mass production and standardized practices developed at a time when management was recognized as a functional element in production. Management had been learning the value of utilizing the human element in production. The more experienced

and wiser managements realized the value of experienced work groups and planned for stabilized or standardized work forces.

LABOR DIFFICULTIES

However, despite efforts to stabilize work groups and because of increased efficiency in production, we find ourselves today with a serious unemployment problem. There has been a steady decline in the number of employees in manufacturing industries since 1919. Just what has been the industrial fate of these workers we have no records to tell us. Increasing use of power machinery and standardization of production have contributed to increased productivity. Fewer workers produce greater output. Since industry has increased its productivity, unless management can sell correspondingly increasing output, either fewer workers will be needed or all members of the work force must work fewer hours.

It is clear that if through increased productivity per man hour the production per man hour doubles, and if at the same time production during the day increases by only fifty per cent, that less hours of work are necessary to produce the daily output. As experience of the last years teaches the development is as follows: Instead of decreasing the number of hours per day the manufacturer either does not change the number of hours or even lengthens the working day and dismisses all superfluous workers. We find that as far as experience goes concerning hours of work and employment, the new standardization programs resulting in increasing production with smaller production costs per unit, have worked against Labor but it is by no means necessary that they work against labor. Therefore, labor is not opposed to them but realizes their dangers and urges study of them.

New standardization programs which have resulted in increased production with smaller production costs per unit, have brought serious problems and hardships for labor. Labor recognizes that standardization or any other efficiency practices need not work a hardship on labor. As we recognize that the fault lies with the application of method and not the method itself, we do not oppose standardization but seek the corrections for faulty procedure.

SEASONAL FLUCTUATIONS

Quite apart from the employment difficulties due to technical changes is the program of standardizing the working force. Employers begin to realize how wasteful and costly seasonal fluctuations in production resulting in seasonal fluctuations of unemployment are. The number of workers employed fluctuates continuously and so does the composition and quality of the working force. In the dull seasons workers are dismissed, often very skilled men, and in the boom seasons more and more workers are employed often regardless of their efficiency and skill because of dire need of them to fill the orders pouring in. In many establishments and in quite a few industries manufacturers, therefore, try to eliminate these seasons and try to distribute production more evenly over the year as a whole. In doing this they provide work for a "standard force" of workers, skilled men experienced in their jobs. Employment becomes stable. At the same time they try to keep up not only the number of workers, not only the skill, but try to keep the same workers. They try to diminish labor turn-over. For, labor turn-over is expensive. Even the most skilled worker cannot

work with the greatest efficiency if he is not accustomed to specific working conditions of the individual establishment.

The workers dismissed from industries where standardization and other efficiencies have increased productivity, may have gone into other industries, or entered new industries, or they may have been added to the groups of unemployed. The Federation knows from its reports of unemployed trade unionists that there are many unemployed. We learn from relief agencies that requests for aid have grown in number.

The workers today present striking contrasts. Many who are fortunate enough to keep their jobs have higher wages and higher living conditions than the workers in any other country. On the other hand, the number of unemployed has risen.

WAGE STANDARDS

A second major problem which Labor finds in mass production is to keep the incomes of wage earners increasing sufficiently so that they may share in the increasing number of commodities for sale and keep pace with higher standards of living and national progress. Not only does Labor find social reasons for seeking to increase its income but there are urgent industrial reasons. If purchasing demand does not keep pace with increased output, the products remain unsold on the market and depression sweeps back to the factories. With depression production plans are curtailed, fewer people are employed, and the number of persons who could maintain their usual buying capacity today is definitely smaller.

Organized labor realizes that the greater mass of products at cheaper prices due to standardization of industry are a general benefit and the harmful consequences to Labor and the community are unnecessary if enlightened policies are followed. The American Federation of Labor, therefore, does not oppose mass production but asks management and unions to eliminate any undesirable consequences of standardization.

To help in meeting the social and industrial problem of adequate increases in wage earners' incomes to enable them to share in national well-being, organized labor has written into its official declarations a statement on wages which provides three measuring rods for wages—higher money wages—higher real wages—and higher social wages. High wage standards are an essential factor in American well-being. Incomes of purchasers must keep pace with progress in production technique. Our studies of wages show that wage increases have not kept pace with output.

VOCATIONAL EDUCATION METHODS

Our third problem, that of vocational education methods adapted to the new industry, is one upon which little progress has been made. Old apprenticeship training is not applicable for workers in mass production. Job training is the customary substitute, but there has been no educational training that provides the unity of understanding between the separate processes necessary to the completed product.

There are, of course, in mass production industries craftsmen who have this sense of unity from their training for the hand industries where they finished their products, but there are many new workers coming into the industry who have not this background. In order to have in industry this opportunity for all workers to use their intelligence, they must be educated to an understanding of the production process as a whole and to share in

directing policies which affect their daily work. Under these circumstances they may increase their value to the industry and may keep on developing mentally through the problems of their daily work.

Standardization programs which bring great benefit to workers are the safety codes for industries. These codes presuppose certain uniformities in working conditions and standardization of machinery. The codes themselves tend to standardize procedures and working conditions and to promote better conditions. However, here as always, we must be on guard not to let standardized practice dull observation and discourage investigation. Our first records of industrial accidents were related to production. When mass production first made big increases in production, we saw accident rates based on production declining and congratulated ourselves on the safety programs. However, when keener observation noted that more accidents were occurring upon a basis of the number of hours spent in industry, we got a new grasp of the safety problem and turned to a new standard.

BENEFITS OF STANDARDIZATION

Like most human mechanisms standardization contributes to progress when employed under a control which takes into consideration the welfare of all groups concerned, but may tend toward stagnation when applied automatically without critical observation.

To sum up: Standardization practices have brought definite benefits in the form of higher standards of living. Standardization of products and subsequent lower costs, and standardized methods of deferred payments, known as installment buying, have made it possible for working people to enjoy many things and to make investments that would otherwise have been quite beyond their incomes.

On the other hand, increased productivity and output have been accompanied by rising unemployment, inadequate wage increases, new problems in industrial education, new problems in workers' organizations, new problems in employment stabilization. Those problems must be dealt with constructively if we would avert industrial depression and social unrest. New standards for industrial relations are necessary and the workers must have a voice in deciding upon them. Labor believes that difficulties can be adjusted and that standardization may be wisely directed to avoid minimizing Labor's share in industrial and cultural progress.

Standardization

By Matthew Woll

Vice-President, American Federation of Labor; President, International Photo-Engravers' Union

PERHAPS it may be safe to say that labor favors standardization where standardization does not restrict or standardize human life, but the more deeply the problem is analyzed the more difficult it becomes to make any sort of dogmatic statement.

The reason for this is that our whole industrial fabric is in a state of constant change, growth and development, and no man can be quite sure of where we are going. The best any sincere man or group can do is to seek as far as possible to safeguard human interests in this era of stupendous development.

There are men who worship standardization today with an almost idolatrous fervor. I think they stand an excellent chance of waking up, perhaps day after tomorrow morning, to find most of their creed washed out in a tidal wave of change. Their materials will have given way to something new and they will have to plunge into uncharted realms once more.

I know very well that in a great many circles the man who does not enter with a neatly arranged plan, with a set of doctrines, with a rounded and sonorous formula, and with assurance about everything, is set down as something of an old fogey, perhaps reactionary, certainly not of the elect who are "doing things" and providing guidance for the race. I must assume the risk. I have no formula. I know of none in our labor movement. But let me hasten to say that the labor movement offers to our wage-earning masses the only protection there is against those who have the formula for so many things and who seek so avidly to force it down the throats of everyone else.

Growth of Standardization

Standardization has made great strides in the last few years. The war compelled standardization in many fields, because the war made strict economies necessary in fields where such economies had not been necessary before. We have standardization in materials, in methods and in processes, in styles and in performance. We have come to have certain standard sizes for certain things, and the list of such things has grown amazingly. In some fields standardization avoids endless and wasteful confusion as, for example, in the small matter of electric fixture connections and plugs. But in other fields standardization would rob life of its artistic effects and of its individuality of taste.

To set up standardization as a fetish, as any sort of a great remedy for any considerable group of human problems or woes, is just so much foolishness. Let us have sense enough to take our standardization or let it alone.

The earlier efficiency or stop watch systems were efforts at standardization, seeking to create a standard workman, each of whom should do so much per hour by following prescribed movements. The labor movement fought against the villainy with such a vigor and determination as it has shown in few struggles. Today there are precious few efficiency engineers who have not joined the labor movement in condemnation of that early miscalled efficiency which at the time was offered to us as something of gospel purity which only the lazy and ignorant would refuse to accept.

APPROVALS AND OBJECTIONS

We approve standardization where it seeks to make toil easier, where it aims to conserve materials, where it simplifies the mechanics of life. But we object to standardization where it seems to rob life of its diversity, to take away its beauty, to infringe upon its freedom.

Let me admit freely that the best we can do is to use our judgment as problems come. We may be wrong more than once, but so may others. In an age when an industry may be wiped out by an invention that comes to us over night there is in regard to many of our gravest problems no time for more than an almost casual consideration. The ball cannot be pitched over again. That is the speed of social change. We have just been informed of the creation of a machine that obeys a command given over a telephone and that performs work in response to such commands. Only today, as I write, the newspapers exclaim over the invention of a motor that takes its energy from earth or air, or both. It may not work as a practical thing, but Mr. Televox does work, and other things almost as revolutionary are happening every week.

I cite these things merely by way of prelude to my thought that it is well to set store by standardization in so far as it seems to serve human needs in the broadest sense, but it is also well to beware that we do not tie ourselves fast to something that, in the swiftness of things, may not be left far arrears by tomorrow. We go too fast to say of anything today, "this settles it."

CONCLUSION

What humanity can do and ought to do—and probably in the main is doing—is to seek to work out that which is best in every way, but to be ready for change where material things are concerned. The one place where standardization can be constant is in human relations, in human conduct. There are rules of conduct—standardized rules of behavior, one towards another—that have had no corners clipped from them in at least two thousand years. It is a poor thing if there is a standardization that saves much labor and material in the making of coffins, if at the same time there is a violation of these long standardized rules of fair human conduct in the treatment of the workmen by those in whose factories these standardized coffins are made. To keep life free is the great thing. To give life its chance at diversity is also the thing. There is a certain tendency toward standardization in the schools about which I have grave fears. There are, too, many persons who almost assume to usurp the place of Deity and to say, "All children and all men and women should be thus and so," and this I do not like. Standardization has its places and its uses. So has everything, even adversity and even the right of the common run of us to be fools and roamers and dreamers, if so the spirit moves.

Let us use standardization as a tool; let us not allow it to become a master.

The Work in the Field of Standardization of the American Society for Testing Materials

By C. L. Warwick

Secretary-Treasurer, American Society for Testing Materials

THE American Society for Testing Materials had its beginnings in 1898, when there was formed in Philadelphia an American Section of the International Association for Testing Materials, which had been organized in 1895 as a result of informal meetings of various European workers in experimental engineering that had been going on for fifteen years. It was soon realized by the American members that an independent organization could best carry out the objects that were in view, and in 1902 the members of the American Section brought about the incorporation of the American Society for Testing Materials, declaring its objects to be: "The Promotion of Knowledge of the Materials of Engineering and the Standardization of Specifications and Methods of Testing."

The Society Today

The Society today is a national technical society of 4200 members, including some 400 in foreign countries. The membership is drawn from all of the important industries of the country and includes: (1) Producers of raw materials, semi-finished and finished products in the metals, cement and ceramics, paints and oils, petroleum products, timber, coal and coke, rubber, textiles and other fields; (2) such major groups of users of materials and products as railroads and allied interests, shipping industry, automotive industry, electrical manufacturing industry, public utilities, construction and building interests, and federal, state and muncipal governments; and finally, (3) the so-called "general interest" group, including consulting engineers, testing experts, educators, and technologists and scientists affiliated with government departments and technical schools.

Membership is held by individuals, companies, firms, corporations, industrial associations, testing laboratories, federal, state and municipal departments, universities and technical schools, technical societies and libraries. There are about 1150 company, firm, corporation and industrial association members, and 2750 individual members, the majority of the latter having affiliations with the various groups that have been named.

The purposes of the Society are carried out broadly in two ways. The "promotion of knowledge of materials of engineering" is effected through investigations into the properties of materials by committees and members of the Society, and by joint researches with other groups, the results of which are presented at annual meetings as reports and papers which are discussed and published in Proceedings (about 1800 pages annually). The "standardization of specifications and methods of testing" is carried on through representative committees as described later.

The major sources of income of the Society are the dues of its members and the sales of its publications, the ratio between these two being approximately 3 to 1. In 1927 the Society's income was about $108,000. Approximately

50 per cent of the annual income is spent directly in the development and promulgation of standards, the remainder being expended for activities in the promotion of knowledge of engineering materials, including publication of technical reports and papers, and for administrative and promotional work. The entire income is applied directly to these purposes; the traveling and other expenses of committee members (of which there are about 1450), and the cost of investigations carried on by the committees, are borne by the members themselves—in other words, for the most part by the industries that are participating in this work. These indirect annual contributions to the work of the Society are approximately three times as great as the actual income of the Society.

STANDARDIZATION WORK OF THE SOCIETY

The standardization work comprises in general: (1) the development of methods of testing materials, (2) the setting up of standard definitions and systems of nomenclature, (3) the formulation of specifications defining the quality and tests of materials and products, and (4) the preparation of recommended practices governing certain processes in the utilization of materials. The actual work of developing standards is assigned to standing committees, which function under carefully prescribed rules. These committees are authorized also to conduct studies and research in the field of materials, whether or not such studies may be in any way related to standardization. Their reports are made annually to the Society, which has the final responsibility for the standards.

BASIC PRINCIPLES

With the great complexity of our industries, the producer and consumer of materials have become rather definitely separated in the industrial scheme. In general, the consumer buys a finished material or product, made ready-to-hand by arts upon which he can exert no direct influence. The manufacture of these materials and products has become highly intricate and specialized; quantity production and economic considerations require relatively fixed processes, subject only to gradual modification and not to be varied at the option of the user. The consumer cannot be fully informed of the processes of manufacture and their influence upon the properties of the materials he uses, while the producer is not familiar in detail with the problems that arise in the many and varied uses to which his material is put. However, only those standards for materials that are satisfactory to these two parties at interest can ever come into general commercial use. Accordingly, the Society from the beginning adopted the principle that the producer and consumer of materials must be brought together upon an equal footing in committees that are to develop commercial standards for materials, and all such committees are made up on the basis of adequate representation from these two groups and from a third or "general interest" group, comprising independent authorities who have expert knowledge of the materials to be studied but who are not concerned directly with either their production or use. The "producer" group may not predominate on any committee.

A second basic principle is that standards shall be founded upon as accurate knowledge as possible of the properties of materials and upon suitable tests for determining such properties. Finally, it is a third principle that every opportunity shall be afforded for all interests fully to express their views, both in committees and before

the Society, to present data bearing upon standards in course of development, and in every way to participate in the decisions that lead to standards. This is insured through the procedure that now governs committee and Society action on standards.

PROCEDURE

The steps in the development of a materials standard may be outlined briefly:

1. It is first necessary to agree upon acceptable methods of determining the various properties of the material This usually involves a large number of comparative tests by various methods.

2. There should be agreement as to accepted definitions of terms relating to the particular group of materials, products and processes involved.

3. The committee then discusses requirements of proposed specifications. Here full account must be taken of the influence of manufacturing processes, the nature of stresses and other conditions to which the material will be subjected in service, and the particular properties of the material that enable it to give satisfactory service. Painstaking investigation and study of experience accumulated over years of service are often required before an adequate specification can be prepared. The committee must come to agreement upon the properties of the material to be specified, the methods of test, such details of manufacture as may be necessary, methods of inspection and of marking, and so on. In all of these things it seeks to follow the best commercial practice that has been developed in supplying the particular material or commodity to the trade. Specifications for materials upon whose strength and reliability the safety of human life may depend must be especially carefully drawn and provided with adequate safeguards in testing and inspection. At times a compromise between the somewhat extreme views that may be held by producer and consumer is necessary in reaching at least a tentative agreement upon certain details, although the more clearly the problems involved are understood and the more complete are the technical data that can be presented on the subject, the more easily can a logical, rational agreement be reached.

4. After full consideration at meetings and final action by "letter ballot" of the entire committee, the proposed standard is presented to the Society for discussion and is published for at least a year as "tentative." In that status it is, so to speak, on trial by industry, where either its suitability will be established or desirable modifications indicated.

5. When a "tentative" standard either has been found acceptable or has been suitably revised by appropriate committee action, it may be proposed to the Society at an annual meeting for adoption as "standard," which requires a "letter ballot" vote of the Society membership.

6. Revisions of standards may be considered at any time, since the committees are continuing committees responsible to the Society for the standards they have formulated. The procedure for revisions is substantially the same as for new standards.

It is recognized that occasional revisions in quality standards for materials are necessary to keep abreast of improvements in manufacturing processes, changes in design and construction, development of new materials, or for other reasons. A policy that has worked well has been to make it possible to revise tentative standards annually, but standards only once in three years.

COMMITTEE ORGANIZATION

Under this procedure, the Society has organized and now maintains 45 standing committees, upon which about 1450 individuals, companies, laboratories, etc., are serving. (The aggregate membership, including duplications, is over 2000.) These committees cover a wide range of engineering materials. Many of them cover so large and diversified a field that extensive sub-committee organization is necessary; there are approximately 300 such sub-committees. Certain committee work undertaken in coöperation with other bodies is referred to later.

Attention is directed especially to the fact that many of the memberships on these committees are held by industrial firms, companies, corporations and associations representing the production and consumption of materials, who appoint official representatives to attend meetings and in other ways to assist in the work of the committees. The industries of the country are therefore participating actively, directly and in a responsible way in the development of materials standards through the instrumentality of the Society.

SUPPORT GIVEN SOCIETY WORK

Support of American Society for Testing Materials standardization work by industry manifests itself in various ways:

1. The support of and carrying on of research to further our knowledge of materials and to bring into existence the data that necessarily underlie the development of standards. This usually takes the form of contributions of material, laboratory facilities, time of laboratory men, technical supervision, and at times direct financial contributions.

2. The contribution to the committee work of information and experience obtained in the actual production and use of materials.

3. The contribution of time and traveling expenses of committee members which, considering the magnitude of the field of materials and the extent of the committee organization, is unquestionably a very considerable sum.

4. The actual use of A. S. T. M. standards and the promulgation through purchase of standards, reprinting, incorporation in general industrial standards and the like.

In summary, it will be seen that the Society, with the help of industry, the government and educational institutions, is providing a forum for the discussion of materials and the development of equitable standards, and has at hand the complete "machinery" required to develop such standards from their first inception through all the stages of investigation and discussion to their final promulgation in industry.

WHAT HAS THE AMERICAN SOCIETY FOR TESTING MATERIALS ACCOMPLISHED IN MATERIALS STANDARDIZATION?

The answer to this question is the 515 standard and tentative specifications, methods of test and groups of definitions relating to materials that the Society has developed. These are published in two volumes: Book of A. S. T. M. Standards (1850 pages) and Book of A. S. T. M. Tentative Standards (900 pages), a total of over 2750 pages of technical standards. A condensed list of materials and products covered in these standards is given below:

Steel Rails and Track Accessories
Structural Steel
Spring Steel and Springs
Reinforcement Bars and Wire
Steel Blooms, Forgings and Axles
Steel Wheels and Tires
Steel Castings
Steel and Iron Tubes and Pipe
Automobile Steels
Boiler Steels

Bar Steels
Tool Steel
Iron and Steel Chain
Magnetic Properties of Iron and Steel
Chemical Analysis of Steel
Heat Treatment of Steel Objects
Wrought Iron
Pig Iron
Cast-Iron Pipe
Cast-Iron Wheels
Malleable and Gray-Iron Castings
Chemical Analysis of Pig and Cast Iron
Ferro-Alloys
Ingot Copper
Spelter, Lead, Nickel, Aluminum Alloys
Brass and Bronze
Solder and Babbitt Metals
Copper and Brass Plates, Pipe, Rods
Condenser Tubes
Wire and Cables
Screen Wire Cloth
Chemical Analysis of Non-Ferrous Alloys
Metallographic Testing
Cement, Brick, Sewer Pipe, Drain Tile
Lime and Gypsum
Hollow Building Tile
Refractories
Concrete Aggregates
Reinforced Concrete
Paints and Oils
Shellac
Pigments
Analysis of Pigments
Petroleum Products and Lubricants
Road Materials
Coal and Coke
Timber and Timber Preservatives
Shipping Containers
Waterproofing Materials
Rubber Products
Insulating Materials
Textile Materials

Mention may appropriately be made of the following materials for which specifications and tests are in course of development today:

Various metals and metallic products for service at high temperatures
High-tensile steel forgings
Marine boiler steel
Zinc-coated sheets, wires, pipe and other products
Non-ferrous refrigerator tubing, sheet nickel, strip zinc, bronze and other castings, aluminum light-casting alloys
Metallic materials for electrical heating
Brick, hollow tile and other types of building units
Refractories
Paint pigments, shellac, varnish and linseed oil
Naval stores
Tests of petroleum products
Forms of specifications for domestic fuel oil
Road materials
Bituminous waterproofing and roofing materials
Grading rules for structural timber
Tests for electrical insulating materials
Performance tests for rubber products
Slate and building stone
Test methods and tolerances for cotton fabrics, rayon, textile goods used in the electrical industry, woolen and knit goods and cords

The standards of the Society are widely disseminated throughout the industries both in this country and abroad. The Books of Standards and Tentative Standards are customarily printed in editions, respectively, of 6000 and 2000 copies and are distributed to the members and through sales. Upwards of 50,000 reprints of the separate standards are sold annually.

COÖPERATIVE RELATIONS

The subject of tests and specifications for materials lies across, so to speak, the entire field of engineering and touches all the major industries, so that the Society has necessarily been closely in touch with many organizations working in the industrial and engineering fields. It has been the policy of the Society to coöperate with those organizations that were interested in the development of materials standards, and for many years such coöperative relations have been maintained with the leading engineering societies of the country, with government departments and bureaus, with technical associations in the various industries, and with industrial and trade associations.

This coöperative work takes several forms:

1. In the carrying out of research and investigations of materials,

the government laboratories in particular have been most helpful. Among these are the Bureau of Standards, Bureau of Mines, Bureau of Public Roads, Bureau of Chemistry, the Forest Service, Naval Engineering Experiment Station and Watertown Arsenal.

2. The coöperating organizations have become affiliated with the Society, either officially as a group or unofficially through individual memberships; they appoint representatives to serve upon the committees and thus participate directly in the development of standards in which they are interested. The policy has been maintained of placing representatives of government departments and technical societies upon committees irrespective of actual membership in the Society.

3. Joint committees are formed upon which various interested groups appoint representatives; such committees report to their parent societies and very generally succeed in bringing about concerted action among the coöperating groups.

4. An adaptation of the preceding method is being developed through the formation of "Sectional Committees" under the procedure of the American Engineering Standards Committee (see below).

INDUSTRIAL AND TRADE ASSOCIATIONS.

It is well known that there has been in the past ten or fifteen years a marked increase in the number of industrial and trade associations that have been formed by various industries for consideration of matters of mutual interest to the members of those industries. These industrial and trade associations are able to speak for their industries to a degree that was not possible in most industries ten years ago. This has had a noticeable effect upon the committee work of the Society, in that these associations serve to concentrate thought of their industries on given problems, to stimulate investigations of properties of materials in which they are interested, to bring about more readily a consensus of opinion on technical matters, and in general to accelerate standardization along many lines, including that of tests and specifications for materials. As these associations have turned to the study of materials problems, the need for close coöperation between them and the Society has been realized. The Society has kept pace with this development. These associations have been encouraged to become affiliated with the Society and to work out their materials standardization problems in coöperation with other groups through the committees of the Society, upon which they are given representation.

There are 67 technical, industrial, and trade associations in this country that are members of the Society, and of these 55 are represented either directly or indirectly upon committees of the Society. There are 53 technical societies and industrial and trade associations, not members of the Society, that are represented upon committees of the Society, upon joint committees with the Society or upon American Engineering Standards Committee "Sectional Committees" for which the Society is a sponsor.

DEVELOPMENT OF AMERICAN ENGINEERING STANDARDS COMMITTEE AS MEANS FOR COÖRDINATION

The need for establishing suitable means whereby the technical societies, government agencies, and the industrial and trade associations could better coöperate with one another in the formulation of engineering and industrial standards, and avoid duplication of standardization work and the promulgation of conflicting standards, was one of the principal factors that led to the formation of the American Engineering

Standards Committee in 1918 by five national engineering societies, of which the American Society for Testing Materials was one.

The Society's activities are being coördinated with the procedure that has been established through the American Engineering Standards Committee for correlation of standardization activities. Several committees of the Society have been or are being enlarged in scope and personnel, principally by the addition of officially appointed representatives of organizations that heretofore have not been represented, so as to function as "sectional committees" under American Engineering Standards Committee procedure, whereby the standards of the Society as they are developed may normally be cleared through the American Engineering Standards Committee as American Standards. This has resulted in still closer coöperation between the American Society for Testing Materials and other interested bodies, extending the review of materials standards by the industries of the country and facilitating their more general adoption and use. Some 45 American Society for Testing Materials standards, selected primarily because of their general acceptance in industry, have so far been cleared through American Engineering Standards Committee procedure.

The Society has also undertaken the sponsorship under American Engineering Standards Committee procedure,—in some cases jointly with other organizations,—of a number of standardization projects in the field of materials for which it has organized "sectional committees" that function substantially in the same way as its own committees, and whose reports and recommendations will be received, acted upon and published by the Society in accordance with its present policies. The principal projects of this kind are:

Zinc and Zinc Ores
Zinc Coatings of Iron and Steel
Cast-Iron Pipe
Iron and Steel Pipe and Tubing
Copper Wire
Cement
Drain Tile
Fire Tests of Materials and Construction
Methods of Testing Petroleum and Lubricants
Methods of Testing Road Materials
Rubber-Lined Fire Hose
Methods of Testing Wood
Classification of Coal

In addition, the Society is coöperating in sixteen American Engineering Standards Committee projects under the sponsorship of other organizations.

INTERNATIONAL ASPECTS

There has recently been considerable discussion of the formulation of international standards. The Society is in sympathy with the endeavors that are being made at the present time looking towards more intimate relations between national bodies throughout the world dealing with technical problems including standardization, and has declared its willingness to coöperate in such international efforts within the scope of its work.

The Society has taken a responsible part in various discussions of international standards. It has been represented for some years in the activities of the International Electrotechnical Commission. The recent reorganization of the New International Association for the Testing of Materials (replacing a former association that was dissolved as a result of the World War), in which the American Society for Testing Materials has represented American interests in the materials field, affords a worth-while opportunity for international consideration of the properties and tests of materials.

PROMOTION OF KNOWLEDGE OF MATERIALS

A description of the standardization activities of the American Society for Testing Materials would be incomplete without some reference to its important function of advancing the knowledge of engineering materials. This work, which is fundamentally fully as important as the work of standardization, is carried on through investigations and researches by committees of the Society and the presentation and discussion at meetings of papers on properties and tests of materials. These reports and papers are published annually. Among typical recent studies of this kind may be mentioned: resistance of various metals to corrosion; effect of sulphur and phosphorus in steel; properties of metals at elevated temperatures; fatigue of metals; magnetic properties of steel; value of various types of preservative coatings, including paints and metallic coatings; the properties of cement and concrete and of such products as brick, sewer pipe and tile.

The importance of extending and amplifying knowledge of engineering materials cannot be emphasized too strongly, for upon the efficient, economic use of materials depends in no small measure the progress of our civilization. It is likewise obvious that this knowledge of materials underlies all basic specification work, for the more complete our knowledge the more clearly can specifications be written and the more valuable will be the standards that are set up.

USE OF STANDARDS

The Society cannot, of course, enforce adoption of its standards. Their use in industry must therefore rest upon their merits and upon the fact that the very way in which they have been formulated, jointly by producer and consumer, has presumably brought into existence a fair equitable standard that can be readily introduced into industry to the advantage of both buyer and seller. The methods of test must be scientifically and technically sound and accurate, and at the same time practicable. The specifications must form an adequate basis both technically and commercially for the exchange of materials between producer and user.

HOW ARE THE STANDARDS USED?

Following are various ways in which the standards of the Society are used:

1. They are used without modification, as published by the Society, or as reprinted by various parties who have adopted them in their practice.

2. They are used by reference. For example, contracts will require material to conform to certain A. S. T. M. specifications or to be tested in accordance with A. S. T. M. methods, giving them by title; or the A. S. T. M. standard may be abstracted or quoted in full as a part of such contracts. The specifications of individuals, companies, governmental agencies and associations likewise refer to, abstract, or quote in full A. S. T. M. requirements. Building and other codes, standards for design and construction of machinery, buildings and other structures, roads, etc., and general construction specifications, will refer to A. S. T. M. standards for quality and tests of materials.

3. The standards, where not adopted outright, are used as the basis of specifications written by various units in industry. This is a truly important use of standards; for however desirable it may be to have all interests agree on a single standard where such a thing is possible, it is a fact that the tendency towards individuality in the writing of specifications is a strong one, so that the

setting up of something that can be used as a guide to those who feel they must write their own specifications is a tremendous factor in preventing even greater diversification than exists today. Uniformity in form and arrangement of specifications for materials, which has been brought about through the establishment of A. S. T. M. standards, itself tends to simplify the writing of materials specifications and reduces diversification. In such situations there is gradual convergence towards a common standard, which will come into existence and general use when it becomes evident that the differences between a number of specifications are so minor as surely to justify the setting up of a single specification. An examination of many of the specifications for materials listed in the Directory of Commodity Specifications shows the undoubted influence of A. S. T. M. standards as the basis of specifications written by other agencies.

4. Moreover, the A. S. T. M. specifications have been expressive of American practice and have therefore been of particular value as standards for export business in materials. Since 1916 the Department of Commerce has translated into French and Spanish over 60 specifications for materials active in export trade. Revised Spanish editions of some 35 of these being in greater demand commercially, have been issued; and 15 specifications for materials entering into trade with Brazil and Portugal have this year (1928) been published in Portuguese. These foreign language editions of A. S. T. M. specifications have been distributed by the Department of Commerce among the American Consuls and Commercial Attachés in various countries throughout the world and have been very largely used by American industries engaged in export business.

It is worth pointing out that standards are not always made for immediate use. As in all things, a start must be made. Often standardization projects are undertaken with the definite knowledge that much pioneer work must be done, and perhaps that much prejudice and opposition must be overcome before the benefits of the particular standards will be realized. Hence the first standards of a group developed under these circumstances can be expected to come only gradually into use, and be subject to frequent revisions as further progress is made. There are a number of examples of this kind among materials standards, but such standards, nevertheless, serve the very important purpose of concentrating thought and discussion upon some definite proposal that eventually will lead to effective standardization.

INDUSTRIAL SIGNIFICANCE OF STANDARDS FOR MATERIALS

"Of what real value to producers and users of materials are these standard specifications?" This question was asked much more frequently in the past than it is today, when so many of our industries are keenly alive to the value of standardization. But while much has been accomplished in the introduction of standard specifications and tests for materials into industrial and commercial transactions, much more remains to be done, especially in some of the industries that have been slow to develop standards, and it is here that the answer to this question is of particular interest. The benefits to both producer and consumer in the industries where standard specifications have been applied for any length of time are so evident and so well understood that the question can be answered convincingly. There are such general advantages as result from the thorough knowledge of the properties of a material and its performance in

service; from the increased uniformity and reliability of the material; and from the tendency of quality standards to improve the whole output of a commodity of which any considerable portion is purchased according to such standards.

So far as the producer is concerned, there are certain advantages of particular importance. For example:

1. He is not compelled to supply, for essentially the same purpose, materials ordered to a variety of specifications that may differ by just enough to require separate production under each specification, involving many classifications in production, in stock piles and the like, without commensurate benefit to the user. When a single specification is accepted for such material, quantity production is then possible, with resulting economy in manufacture and distribution that is eventually reflected in lower prices.

2. Under standardization, with respect both to dimensional and quality standards, the manufacturer, in times of general business depression when his orders are low and buying is practically at a standstill, can continue to produce "standard" material knowing that when business picks up there will be a market for it. In this way he keeps his plant running and his organization intact, avoids excessive labor turnovers, prevents large increases of overhead expense in relation to output, can frequently take advantage of favorable market conditions in purchasing raw materials, and in general maintains the efficiency of his operations. Such considerations as these are of great importance in that they substantially reduce the waste in industry, which is an economic burden upon the entire community.

3. The adoption of standards reduces the variety of commodities that must be kept in stock by producers and distributors.

4. The producer knows exactly what he is expected to furnish and how the material will be tested and inspected by the consumer, thus reducing to a minimum the possibility of misunderstandings, which are both vexatious and expensive.

These benefits to the producer are indirectly of advantage to the consumer, of course. But there are certain other advantages that the consumer experiences in the use of standards, which may be enumerated as follows:

1. He can secure truly competitive bids on the same quality of material—a condition that is greatly to his advantage. Truly competitive bidding under a quality specification is welcomed by the progressive manufacturer.

2. The details of purchasing are simplified and standardized—a matter of especial importance in large organizations.

3. Standard methods of test and inspection are of particular value in establishing a routine procedure for acceptance of material.

4. The greater uniformity and reliability of material purchased under standard specifications, and the fact that its properties are more thoroughly understood, make possible its more economic use.

Of course, it costs the consumer something to prepare these specifications and to inspect material purchased under them, but this cost is more than offset by the savings incident to the advantages that have been named.

It may be said in general that careful inspection and testing of material is necessary to insure proper deliveries under any specification. Often the manufacturer will furnish a certified statement that he has tested and inspected the material and that it meets the requirements of the specification,

and such a certificate is generally accepted by the buyer as evidence of satisfactory delivery. While much more might be said regarding the enforcement of specifications, it is well to remember that standard specifications are not a general panacea for commercial ills, and that the thoroughly reliable producer who knows his product, carefully inspects it, and puts his reputation back of it, has just as important a place in industry today as ever.

The importance of standardization in relation to future industrial development can hardly be overestimated. Our industries within comparatively recent times have multiplied very rapidly, and not sufficient attention has been paid to the economies that are possible in simplifying types, design and dimensions of commodities, and in standardizing materials and practice. In its essentials standardization is simply a process of selection of types, designs, materials or practices that in the course of time have thoroughly proved their value to the general community—a "survival of the fittest"—and a concentration upon these types and materials in production and use in the interests of greatest efficiency. It is only recently that industry has become aroused to the necessity of applying these principles of standardization to problems of production, distribution and consumption. If these principles are properly applied, there need be little apprehension that standardization will weaken the incentive to originate, to invent, and to apply in the industries of the world new types, new materials and new processes, —a criticism that is sometimes directed against standardization. Standardization has been accused of "fixing" practice in such a way as to retard desirable progress in industrial development. This has not been the experience of the American Society for Testing Materials in the field of materials; we have found that the introduction of materials standards has conserved time and energy for the study of new developments that otherwise would be occupied with routine matters, and that standards of quality and tests for materials are readily modified from time to time as new developments take place.

CONCLUSION

Interest in and appreciation of the industrial and commercial value of standards for materials has grown rapidly in the past decade. There are many organizations among the professional and engineering societies, industrial and trade associations and others that have a greater or less interest in the development of such standards. The Society is particularly qualified by the character of its membership, the support given to it by industries throughout the country, the principles and procedures upon which its standardization work is founded, and its experience in this field for twenty-five years, to develop standards for materials. It welcomes the cooperation of all groups that desire to engage in the development of standards for materials and it affords the opportunity through its procedure for other groups and for industries, either through companies or through industrial and trade associations that they may have set up, to participate in the formulation, in a thoroughly representative way, of equitable materials standards.

The Standardization Activities of Underwriters' Laboratories

By W. D. A. Peaslee
Assistant to Mr. Dana Pierce, President, Underwriters' Laboratories

UNDERWRITERS' LABORATORIES is not engaged in standardization work as a primary function. It is true that incidental to the performance of the work for which the Laboratories was organized a certain amount of what may be called standardization is brought about. Through its affiliations, however, by means of memberships of its engineers on the committees of various standard-making bodies, it exercises a very strong technical influence on standardization work in many lines.

Underwriters' Laboratories was started some thirty-one years ago in response to a rather definite need that was sensed by the founder of the Laboratories, Mr. William H. Merrill. With his far-sighted analytical mind he foresaw, even before the underwriting organizations were aware of it, the increasing necessity to rate-making organizations of accurate technical knowledge of facts relating to the hazards introduced by the increasing use of the then new force, electricity.

Fire insurance had grown to be a very important factor in commercial credit to the extent that it had become one of the cornerstones of the structure of our very complex commercial credit system in the United States. A long and rather costly experience had taught the insurance companies that insurance rates to be scientific and a basis for a stable and prosperous industry must be based upon an accurate knowledge of the facts regarding the hazards introduced or protection against fire and accident afforded by the use, storage, and transportation of devices and materials used in the conduct of our industrial life. The insurance world was gradually coming to a realization that this was a very technical problem which should only be undertaken by an adequately organized technical staff and for best results this staff should have absolutely nothing to do with the formation, application, or enforcement of rates for insurance. Mr. Merrill had foreseen this and was prepared in a small way to furnish this service.

The first work of the Laboratories was in connection with the then new art of utilizing electricity, and as the value of this work grew in the minds of the insurance companies the small beginning that had been fostered by Mr. Merrill was taken up definitely and its findings accepted by the insurance companies.

System of Councils

In order to maintain the necessary close coöperative liaison between the technical staff engaged in determining scientifically the hazards and protection above mentioned and the insurance organizations who used the technical information thus obtained in the building of rate structures, a system of Councils, one for each engineering department, was formed by the Laboratories consisting of prominent men in the insurance and inspection fields who were without commercial affiliations. Reports by the engineers of the Laboratories presenting the facts obtained from their examinations of devices and

materials submitted to them, together with the recommendations derived from these facts are presented to the Councils for their review before the resulting classifications are promulgated to the inspection authorities and published in the Laboratories' Lists. In this way the field experience of the insurance organizations and the knowledge of what is required from a rate-making point of view is applied to the technical findings of the Laboratories while the Laboratories itself still remains a separate distinct organization entirely separate from the technique and practice of rate making.

Fundamentally in the nature of the work of the Laboratories it is necessary to measure hazards and protection, and the work of the Laboratories may be accurately stated as that of classification of materials and devices from a standpoint of the hazards or protection involved in their use, storage, and transportation. This classification naturally depends upon the use of some sort of a yardstick, and it is in the development of such a yardstick that Underwriters' Laboratories enters the field of standardization to the extent that certain minimum requirements must be set up to be used in judging devices aad materials submitted to the Laboratories for classification.

INDUSTRY CONFERENCES

In order to secure the best practical as well as theoretical knowledge on this subject, the Laboratories has developed a system of Industry Conferences for this purpose. It is the work of these Industry Conferences, consisting of representatives from manufacturers in the Industry concerned, with the Laboratories that results in the establishment of the necessary yardstick or minimum requirements. The Laboratories' engineers, trained in fire protection and prevention work, working with the Industry Conference draft a set of requirements mutually agreed upon that enable the Laboratories to equably discharge their obligations to the insurance organizations, *i.e.*, to furnish them technical information as to the hazards involved and protection afforded by the material or devices examined, that may be used by them in rate making, and at the same time insure a reasonable protection to the public using the devices or materials and not impose upon the manufacturers an undue economic burden in requiring greater refinement than necessary to produce a reasonably safe device for introduction into our industrial life.

The minimum requirements so set up by the Industry Conference and the Laboratories are then submitted to the proper Council and when finally approved by all three interests become the minimum requirement yardstick by which future devices of this class are judged when submitted to the Laboratories. This is, in effect, a standardization in the form of a minimum requirement such as is essential for the fundamental work of the Laboratories.

FOLLOW-UP AND INSPECTION SERVICE

A further and very important work of the Laboratories is the follow-up and inspection service. This is quite necessary, as it is of no interest to the insurance companies to know that a device submitted to the Laboratories and examined by them is classified in a given manner unless they can be assured that all such devices as later manufactured are at least as satisfactory as the devices originally submitted.

This requirement led to the establishment of the inspection and follow-up service whereby through the inspection personnel of the Laboratories all products of manufacturers

which have been given such classification are followed continuously from that time on.

The findings or classifications arrived at by the Laboratories are made public in Lists which are available upon application to the Laboratories to anyone interested and which also have a very wide distribution throughout the inspection organizations, both insurance and municipal, of the country. These lists supplemented semi-annually and revised annually comprise a total of about 800 pages. In addition to this, regular subscribers to the service are furnished a card upon each device or material classified which, issued as soon as the classification is released by Council approval, describes the device in sufficient detail that it may be recognized and identified in the field, and gives the classification in which it has been placed as a result of the facts brought out in the examination conducted by the Laboratories.

GROWTH AND VALUE OF LABORATORIES

The continuous growth of the Laboratories and the widening of their sphere of interest has been a striking proof of the value of the service they have been able to render. It must be borne in mind there is no legal authority back of the findings of the Laboratories.

It will be seen from this structure that it is a democratic method of standardization giving each of the parties interested a representation in the establishment of the minimum requirements and sufficiently flexible to keep pace with the changes and developments in our industrial life. It is opposite to the autocratic and sometimes despotic system resulting from standardization by governmental authorities and is also free from that inertia liable to result from any governmental standardization.

Since it is deliberately formed as a non-profit-making organization, Underwriters' Laboratories is free of commercial interest and able to render a disinterested unbiased judgment based only on facts properly determined.

Formed as it is and being operated and influenced solely by the properly interested parties, it is free from political influence, while at the same time it secures for itself the practical knowledge of the commercial relations that are necessarily involved. The democracy of this method extends even to the follow-up service which is an inspection controlled entirely by consent of the governed.

Due to the gradual widening of the scope of the demands made upon the Laboratories by the insurance organizations it has grown until at the present time there are seven active engineering departments each concerned with a phase of our industrial life which produces hazards important to the underwriting world. These are supported by a large department devoted to the inspection and follow-up service described.

Some industries based on devices and materials inherently hazardous have been developed by this democratic coöperation between the manufacturer, the Laboratories and the insurance authorities to a point where they are now enormous industries bringing a great service to the public without introducing an undue hazard by their use.

An instance of this is the acetylene industry which employs acetylene gas for illumination and also uses it mixed with oxygen for cutting of metals and for welding. The use of acetylene gas has been a great factor in the rapid economic development of our prosperity. Acetylene gas at certain temperatures and pressures becomes extremely hazardous, as under these special conditions it explodes spon-

taneously. Through the work of the Industry Conference and the Laboratories with the coöperation of our Councils, devices for manufacturing and using this gas have been developed which are in wide use throughout the United States with a very pleasing degree of safety and freedom from accidents. At the same time the Laboratories, through this democratic organization, have been able to keep abreast of the progress in the art so that the using public have not been denied the benefit of the latest developments and inventions. The scope of the work of the Laboratories may be sensed from the following brief outline of the activities of the various departments.

CASUALTY AND AUTOMOTIVE DEPARTMENT

Anti-slip material; belt fasteners; belt shifters; window cleaners' belts and anchors; boiler appliances including safety valves; portable elevators; elevator appliances including cable equalizers; door contacts and interlocks and limit switches; panic hardware; electric hand lanterns; garment presses; electrolytic oxygen and hydrogen plants; oxy-acetylene blow pipes and regulators; high pressure gas gauges; laminated glass; goggles; machinery guards and guarding devices; automobile lifts; ladders and ladder feet; refrigerating machines; air tanks; scaffolds; automobile bumpers; automobile brakes; gasoline tank, fill, and vent fittings; fuel feed systems; fuses; ignition starting and lighting equipment; locking devices; mufflers; radiator guards; signals and signalling appliances; switches; theft detection systems; gasolene tractors, and wire.

BURGLARY PROTECTION DEPARTMENT

Burglar alarm systems, central station and local types; safes as to their burglary resistance; locks and locking devices; bandit resisting enclosures; gas and chemical systems; hold-up alarms; safety deposit boxes; collection safes for daylight robbery protection.

HYDRAULIC DEPARTMENT

Pumps; pump governors and controllers; meters; hydrants; gate and check valves; indicator posts; pipe and fittings; automatic and open sprinklers; accelerators and exhaustors; alarm valves; dry pipe valves; quick-opening valves; pipe hangers; sprinkler guards; hose racks and reels; nozzles; hose valves; pressure gauges; wheeled and stationary chemical extinguishers; and fusible links.

GASES AND OILS DEPARTMENT

Acetylene generators for lighting and welding; acetylene torches; various types of gasoline handling pumps; gasolene engine-driven electric lighting plants; internal combustion engines; gas heaters of various types; suction gas producers; gas systems for use in lighting and heating; gasolene gas machines; gasolene lamps; gasolene cook stoves and heaters; kerosene stoves and heaters; incubators and brooders; oil burners for industrial and domestic use; oil-burning forges and torches; safety cans for hazardous liquids; above ground, underground, and portable storage tanks for hazardous liquids; unions for hazardous liquids, emergency gas shut-off valves; hand fire extinguishers generally known as first-aid fire-fighting appliances including 1½-, 2½- and 5-gallon soda-acid extinguishers, 1½-, 2½- and 5-gallon foam extinguishers, hand pump extinguishers; special types of extinguishers using CO_2 gas stored under high pressure.

PROTECTION DEPARTMENT

Safes; vault doors; fire doors; hinges, locks, hangers, and other fire door ac-

cessories; fabricated blocks of concrete and gypsum; metal lath and other mineral bases to receive and support plaster, metal windows glazed with wired glass, fire shutters; roof-covering materials, building columns, partitions, floors, and various building materials and fire retardants.

CHEMICAL DEPARTMENT

Equipment for use in hazardous and extra hazardous locations including electric motors for use in explosive gas, vapor, or dust-air atmospheres; electric switches and control apparatus for use in explosive gas, vapor, or dust-air atmospheres, lamps, heaters, and miscellaneous equipment for transportation, loading, etc., such as trucks; flame arresters; vent valves for oil storage tanks; fumigants and insecticides; refrigerants; flame-proofed fabrics; films (slow-burning); gas detecting and recording devices; anaesthesia equipment; rubber-lined fire hose; linen fire hose; chemical engine hose; gasolene hose; rubber-covered wires, cords, and cables; electrical tapes; floor oils; sweeping compounds; cleaning fluids and materials; thinners for paints and varnishes; millinery glues; metal polishes; solvents; waterproofing materials; gasolene resisting cements; fertilizers; pyroxylin products; liquefied petroleum gases; extinguisher liquids; foam-producing ingredients and foam charges; anti-freeze extinguisher charges; soldering fluxes; conduit; corrosion resisting metals and alloys; roofing; non-sparking alloys; protective coatings for metals and alloys; terne plate for fire doors; glass cylinders for visible measuring gasolene pumps; carbon blacks; oil resisting paints; tear gas bombs and canisters; textile fibers; fire-resistant safe insulations; compressed oxygen and hydrogen; matches; garage heaters; fuel oils; spontaneous ignition; gas and vapor explosions.

ELECTRICAL DEPARTMENT

Armored cables, cords, and fittings; cabinets and cutout boxes; candelabra and miniature lamp receptacles and sockets; car heaters, electric; Christmas tree lighting outfits; circuit breakers, air-break type; conduit and fittings; fiber, flexible (steel) rigid aluminum, and rigid steel conduit; current taps, cutout bases; elevator appliances; films, slow-burning; fixtures; fixtures and fittings; ground clamps; heaters, cooking and liquid; electric air heaters, electric car heaters, industrial and laboratory heaters, flat irons and ironing machines; insulating devices and materials; lamps and lamp fittings; lightning rods and fittings; motors for use in explosive atmospheres; musical instruments (electric); non-metallic sheathed cable; office appliances; outlet boxes, plates and fittings; paints, insulating; panelboards; picture machines and appliances; raceways for surface wiring; radio appliances; receptacles; rectifiers; refrigerating appliances; resistance appliances; sealing compounds; signal appliances; signaling systems; signs, electric; sign flashers; sockets; automatic switches; enclosed switches; knife switches; oil break switches; snap switches; temperature regulating appliances; time-recording appliances; toys; bell-ringing transformers; power transformers; flexible tubing; ultra-violet ray machines; vapor-proof fixtures; varnished cloth wires; welding machines; wires, asbestos-covered, fixture, flame-proof, flexible cord, rubber-covered, slow-burning, varnished-cloth, weather-proof; and X-Ray apparatus.

RESULTS

The natural result of all this work has been the development of a group of experts on the Staff of Underwriters' Laboratories, whose services are eagerly sought by the committees of the

various standard-making bodies of the United States on account of their expert knowledge over a very wide field. Committee work takes a great deal of the time of these experts, but it increases their usefulness to the public, and broadens their contacts in a manner that is very helpful to the Laboratories. During 1927 twenty-seven members of the Staff of Underwriters' Laboratories served on two hundred and twenty-nine committees in thirty-five different National organizations, societies and conferences devoted to standardization work as such in the United States. Seventeen of these members were chosen chairmen of their respective committees. It is through these contacts that the real influence of Underwriters' Laboratories is manifested in standardization activities in the United States.

Simplification's Boons to Purchasing Agents

By W. L. Chandler
Executive Counselor, Primary Distribution and Purchasing, New York City

THERE was once a chief executive who was afraid his purchasing agent would standardize the styles of women's clothes. He didn't know that has long since been accomplished.

There are many people who still believe that standardization takes all the joy, beauty and individual self-expression out of life. Those people forget that everything God creates is standardized. Every tree, dog and man must meet divine specifications—and yet no two individual instances are ever alike. Without so much standardization of design there would be no digestion, no propagation, no medicine, no speech, no thought, no existence.

In the manufacturing and commercial world there are many benefits to be derived from further simplification, so that men in identical situations can speak the same language and doctor their identical ills with the same castor oil. Some of these benefits are already being realized in a partial way. These can be expanded to greater service and others begun and developed.

A vast number of purchasers would benefit from greater service or use which would be derived from simplified articles. For example, office desks are a horrible example of the need for simplification. Most concerns buy desks from time to time as need arises. When business changes require rearrangement of desks in offices, attempts are frequently made to regroup desks in sets to minimize aisle space. At such times it is usually found that the desks are not of uniform height and that desks of a given length are of varying width. The result looks like a terraced garden.

At the request of the purchaser of a large life insurance company the National Association of Purchasing Agents recently asked Ray M. Hudson, Assistant Director, Bureau of Standards, to call a conference of manufacturers, distributors and users of desks to discuss the simplification of desk sizes. Several such conferences were held, but it was not possible to get manufacturers and distributors to agree on dimensions which would be mutually satisfactory. This was most disappointing to the Association.

The potential benefits to its members are such that having failed through coöperative efforts, the National Association of Purchasing Agents has appointed a committee. That committee is instructed to study the situation and to recommend the sizes which its members should adhere to in their purchases. Some day the purchasers will benefit from that movement in simplification.

Benefits Due to Opportunities for Greater Use

While this is still being worked out there are many other projects where all parties at interest have agreed on the simplification of commodities. Hotels, railroads, steamships, hospitals and institutions have benefits from greater use, fitness and flexibility from simplification of beds, mattresses, springs, blankets, sheets, chinaware, plumbing fixtures and other commodities. Purchasers in the industries, public utilities and government agencies derive benefits in some degree in greater flexibility from the list above mentioned, but more particularly from the commodi-

ties definitely associated with and used by their companies.

The simplification of milk bottles and caps has a very definite bearing on a large group of industries and indirectly on ultimate consumers. Steel lockers, milling cutters and grinding wheels will serve as illustrations of classes of commodities where benefits through greater usefulness are found.

GREATER EASE IN PROCUREMENT

Grinding wheels, however, also serve to illustrate another form of benefit, that of greater ease in procurement. Until the Division of Simplified Practice undertook, at the request of the industry, to bring together those interested in grinding wheels there existed over 715,000 varieties of these wheels. One might conclude that with such a large assortment from which to choose, a purchaser need have no difficulties in procurement. But the condition was quite different. There were so many varieties that manufacturers and distributors could not begin to carry adequate stocks to supply demands from such a wide range. Consequently each purchaser in his supervision of stores for his company was forced to maintain his own stock of grinding wheels to fit the varied demands of his shops.

After simplification, 64 per cent of these varieties were merged with others, eliminating some shades and tints of difference which had grown up because, like Topsy, the grinding wheel industry had "just growed."

After the first steps in simplification there still remain over 250,000 varieties of wheels, but the situation is vastly improved. The fullest benefits from this work are yet to come, but much good has already been accomplished. Distributors will benefit greatly from the work. There will be more effective stocks maintained by distributors and manufacturers and less stock held by consumers.

Similar benefits in procurement are present for purchasers in the building trades and highway projects through simplification of building and paving brick, tile, cement blocks, metal lath, reinforcing bars, structural and roofing slate, eaves trough, conductor pipe, builders' hardware, asbestos paper and millboard, lumber, asphalt, and many other commodities.

Buyers in other lines benefit through purchase of many of the above commodities but, in addition, it is easier to procure their simplified requirements in files, rasps, lumber, forged tools, paper, plow bolts, cotton duck, sheet steel, steel barrels and drums, tacks and nails, shovels, die head chasers, wrought pipe, valves and fittings, steel scrap, and numerous other commodities.

GREATER KNOWLEDGE

A third type of benefit comes from greater knowledge of commodities. As a result of the various Washington conferences, purchasers know more about the fitness of different varieties of materials for specific purposes and are thus able to choose varieties and qualities which are best for the existing purposes.

Some commodities of importance from the standpoint of selection for a purpose are: range boilers, woven wire fencing, bed blankets, hot water storage tanks, chinaware, piston-ring oversizes, as well as the grinding wheels and others previously mentioned.

This type of benefit, selection for a purpose, also involves a type of simplification not yet mentioned, namely simplified invoices. The use of invoices is tremendous. They have existed in such variety of size and form as to preclude description. There were over 400,000 varieties in use. Now all parties at interest have agreed

upon one: the Simplified Invoice Form, for general use. The enthusiasm of purchasers may be judged from the fact that the National Association of Purchasing Agents started the campaign for a standard invoice form in 1918, and has been actively pushing it ever since. A careful survey and estimate indicates a potential annual saving of 15 million dollars when the simplified invoice form has come into general use.

When invoices are all of standard size, and when a clerk may rely upon finding each item of information sought in a definite place on the form, there will not only be the financial benefit but invoices will be audited more promptly, less complaints about cash discount abuses will be heard, and invoices may be filed and found more readily. Another benefit from simplified invoices concerns the vendor, but may well be mentioned here. Formerly, because of the great need for standard invoices, many large corporations designed their own individual private forms and required all bills rendered against them to be on these forms which they provided. In sales of certain industries these private customer invoice forms were particularly embarrassing and involved much extra cost in billing departments of the vendors.

This Simplified Invoice Form designed to benefit the purchasers has thus proven a boon to vendors as well.

The National Standard Catalog size is another form of simplification, originated by the purchasing agents for their own benefit, which has proven of greatly increased value to vendors.

Formerly catalogs were of so many sizes that they were invariably filed according to size. Efforts made to maintain card files to index these catalogs by commodities were ludicrous, because indexes could not be made comprehensive. Consequently catalogs, being improperly indexed, were often lost sight of.

Now catalogs of standard size, 7¾ x 10⅝, are classified according to lines of commodities, and may thus be easily referred to when needs arise. Simplification of warehouse forms and of bank checks, notes, drafts and similar instruments also benefit purchasers, but to less extent than they serve some other types of executives.

DOLLAR BENEFITS

The fourth type of benefit has made less progress in its development. However, it will become a definite and substantial benefit as time goes on. I refer to dollar benefits to purchasers from lower costs of production, distribution and use as demand is directed and diverted to the channels of simplified practice. Some of these lower costs have come about gradually, and competition has brought them out to the consumer. But where the simplification has been complete, and all other varieties abandoned, there are no opportunities for comparison of prices. On the other hand, standard checks, for example, may be bought for two or three dollars per thousand less than the non-standard. In the case of standard catalogs the purchaser benefits on price because, while the standard increased the amount of paper in the average catalog page 50 per cent, it permits 100 per cent more type matter to appear on the page. The consequent reduction in number of pages enhances the effectiveness and reduces the cost of catalogs.

In the case of building materials and many commodities sold by bid or quotation, the savings are lost sight of, but are there just the same. Because human nature is as it is, simplification would be much more in demand if these

price benefits were presented in more spectacular fashion.

The four types of benefits are becoming increasingly recognized and the expansion of interest is rapidly accelerating. As this interest develops the dollar benefits will become more and more evident and will awaken a general demand for simplification in many more directions by production and purchasing executives.

As evidence of the relation between simplification, dollar saving, and the most effective way of accomplishing the end desired, we may consider the methods used in the automotive field. This entire industry is a monument to simplification.

When an automobile manufacturer determines upon further simplification, he immediately translates that determination into the language his customers can best understand. He lowers his price. He does not wait until the savings have accumulated in his cash box before passing some of them on to his customers.

The price reduction really makes possible the accomplishment of the plan of simplification because the automobile buyers obey the impulses thus created and volume production results. Manufacturers, distributors and consumers reap the benefits.

This method of handling price with simplification cannot be applied to all lines of business. It remains for someone who does not know that to accomplish the results.

HOOVER, THE FATHER OF SIMPLIFICATION

The Honorable Herbert Hoover, long before he occupied his Cabinet position, pointed to the then approaching, now present era of competition, not only between businesses but between trades and between nations. He has since given us the Division of Simplified Practice, and more recently the Commercial Standard Group of the Bureau of Standards, through which business men may work out for and by themselves the simplification projects of greatest value.

Competition is furnishing the dollar urge which is leading more and more trades to call upon these organizations for help. About 70 projects have been closed with others in progress thus far, but the purchasers are clamoring for more and yet more that their benefits may increase. The National Association of Purchasing Agents should be and is willing to continue to carry on as the organized representative of consumers.

Years of intimate contacts in production, sales and purchasing with thousands of those who make a profession of purchasing lead me to feel that the principles of simplification may be applied successfully to most commodities and many business practices with definitely beneficial results. Such simplification methods would extend the benefits to all industries, public utilities, institutions and government agencies which constitute primary consumers and which are represented by professional purchasing agents. This movement will do much to help solve some of the numerous problems of distribution and production before us today.

We are all inclined to be so self-centered in our thinking and to adhere so strenuously to our pet ideas of what we require to run our plants, or what we must do to market our products, that we sometimes become obsessed and do not always appreciate our need for simplification. Too often, we must have its benefits forcefully presented to overcome our obsessions.

The dollar is the most forceful overcomer of obsessions. I, for one, hope to see the dollar benefits stressed more

emphatically in the future. Knowledge of the benefits of simplification and of the needs of those who may reap the benefits leads me to hope that we may be able to aid business men in expanding this work, to help business to realize more of the potential benefits which will surely come as we think more in terms of the future and less in those of immediate self-interest.

Development of Standard Safety Codes

By David Van Schaack

Chairman, Safety Code Correlating Committee, American Engineering Standards Committee; Director, Bureau of Inspection and Accident Prevention, Aetna Life Insurance Company, Hartford, Conn.

ONE of the most interesting developments of the last decade or two has been the rapid increase of interest in industrial safety. It was only natural that the astonishing progress in machine production which has placed the United States in the forefront of industrial nations should direct attention to the human waste accompanying it. Machines were first built and placed with regard only to their productive capacity, but the adverse effect of the operation of unguarded machines and those only partially guarded gradually became more and more apparent as the waste of human life and limb resulting from their use attained such proportions that it demanded notice. This waste, of course, made its first appeal to the moral sense, but this was soon supplemented by a steadily increasing belief that accidents in industry have more than an humanitarian aspect—that they have such an effect upon production that they must be taken into consideration from the economic viewpoint.

These two considerations—humanitarian and the economic—have given tremendous impetus to a movement to reduce accidents to the lowest number on the part of all who are naturally concerned with them in one way or another. Many of our larger industries have made organized accident prevention work an integral part of operation. The states have by law and otherwise encouraged the creation of safer working conditions. The insurance companies have lent their influence with their assured to the attainment of the same end. There has been a general effort to cope effectively with the accident problem, of which effort the latest phase is the movement initiated a few years ago for the development of uniform safety codes.

Origin of National Safety Codes

The immediate reason for national safety codes is found in a number of causes—workmen's compensation laws; state laws and municipal ordinances for the protection of workers; regulations of state labor departments and industrial commissions; standards set up by insurance companies for determining the relative hazards in plants insured by them. These proximate causes all hark back to one original cause—new appreciation of the values of human life and limb—and are simply different manifestations of a keen desire to realize these values. It was quite natural, as in all pioneer movements, that the several agencies interested in promoting safety should work independently toward the same end, but the vital need of an attempt to standardize all these efforts soon became apparent. In 1919, therefore, at the suggestion of the National Safety Council, the Bureau of Standards sponsored two conferences at Washington to consider the advisability of such standardization and the best method of forwarding it. There was complete agreement as to the need for uniform and national standards, and

it was finally decided that safety codes could best be prepared under such a procedure in formulating national standards as had been set up by the American Engineering Standards Committee, if the scope and membership of this committee were enlarged so as to make the plan widely acceptable.

The necessary action was promptly taken by the American Engineering Standards Committee. A safety group was added to its membership, and a national safety code committee was formed to act as an advisory committee in relation to the development of national safety codes. This committee is now known as the Safety Code Correlating Committee, and its membership is widely representative of those concerned in safety matters. The United States Bureaus of Standards and Labor Statistics, the International Association of Industrial Accident Boards and Commissions, the Association of Governmental Labor Officials, the national associations of casualty insurance companies, the National Fire Protection Association and the National Safety Council are represented on it as well as engineering societies and some of the leading industrial associations. Work on safety codes is under the advisory direction of this committee, the functions of which include investigating the need for particular codes, defining and limiting the scope of codes, considering the interrelation of codes, passing upon the personnel of technical committees, following up the progress of work on codes, and acting as a general clearing house for matters concerning them. It performs one or more of these functions as may be necessary in connection with all safety codes except those in the field of mining standardization, which are referred to a similar committee known as the Mining Standardization Correlating Committee.

PROCEDURE OF THE AMERICAN ENGINEERING STANDARDS COMMITTEE

Inasmuch as the American Engineering Standards Committee is not an initiating body, work on a code project is undertaken only upon formal request from a responsible body, and then only after the committee has assured itself that it is the desire of industry and others interested that the work shall go forward. A consensus on this point is obtainable in any one of several ways. Generally speaking, the most satisfactory method is to call a conference of the bodies presumably interested in such a project, and ask this conference to decide whether the work shall be undertaken, and, if so, what its scope shall be, how it shall be organized, and how it is related to other work. When such a general conference is not practicable, the opinion of those interested is obtained through a questionnaire or through a special committee composed of representatives of the bodies principally concerned.

When an existing standard is submitted to the American Engineering Standards Committee for approval under its procedure, it is referred to a special committee to investigate whether it has been developed by an organization and procedure conforming substantially to the procedure of the American Engineering Standards Committee or has by actual practice proved its right to become a standard. Steps are taken also to secure information from the technical press and the industrial associations and technical bodies interested regarding the way in which the standard submitted is meeting the needs of industry.

In the case of safety codes, other than those having to do with mining, the Safety Code Correlating Committee coördinates in a capacity advisory to

the American Engineering Standards Committee on the standardization work suggested to, or undertaken under the procedure of, that committee. Organized as it is in a way so broadly representative of the interests concerned in the promotion of safety, it can assume to a considerable extent a major responsibility in deciding whether code projects shall be undertaken.

Once the general desire of those concerned that a code project shall go forward has become evident, an organization, or organizations, outstanding among those interested is asked to act as sponsor for the proposed code. The duties of a sponsor are to suggest the membership of a joint technical committee (officially called a sectional committee) to formulate the code provisions, and to see that the work of making the code is carried on in an effective manner. It is just as necessary, if a code is to become of real practical value, that its provisions represent a consensus of those interested in it as that the need for a code be generally appreciated. A sectional committee for a safety code, therefore, is approved by the American Engineering Standards Committee on recommendation of the Safety Code Correlating Committee only when it includes a balanced representation of those concerned with it. This representation covers:

1. Manufacturers (makers of the equipment).
2. Employers (purchasers, owners, users of the equipment).
3. Employes.
4. Governmental bodies having regulatory power or influence over the field in question.
5. Qualified specialists, such as staff representatives of technical societies, consulting experts with no exclusive business affiliation, and educators.
6. Insurance representatives.

The formulation of a code is thus placed in the hands jointly of those responsible for the administrative and legal aspects of the problem involved, those who must face the technical, industrial and financial sides, and those who have to face the hazards to life and limb. When a code has been formulated, it is recommended by the sponsor for approval as American Standard, Tentative American Standard or Recommended American Practice by the American Engineering Standards Committee, which refers it to the Safety Code Correlating Committee to pass upon the questions as to whether the procedure has been followed and the vote of the technical committee upon the completed code shows a sufficient consensus of opinion. Upon favorable report, the code is then approved and is ready to be brought to the attention of government officials, insurance companies and the industries concerned as a national standard. The technical committee is continued in existence both to provide for revisions of the code as such may become necessary, and to interpret the provisions of the code upon need arising.

SAFETY CODE CLASSES

The safety codes thus developed are of two general classes, one of which deals with specific machines or devices, and the other with certain industries as a whole. Upward of 40 code projects have been undertaken under this American Engineering Standards Committee procedure, and 23 codes have been completed and approved as either American Standard or Tentative American Standard.

The codes which have already been completed are the following:

American Standard

Code on Lighting Factories, Mills and Other Work Places

Safety Code for Elevators and Escalators
Code for Lighting of School Buildings
Safety Code for the Use, Care and Protection of Abrasive Wheels
Safety Code for Power Presses and Foot and Hand Presses
Safety Code for Mechanical Power Transmission Apparatus
Safety Code for Colors for Traffic Signals
Gas Safety Code
Safety Code for the Protection of Heads and Eyes of Industrial Workers
Safety Code for the Prevention of Dust Explosions
Electrical Safety Code ("National Electrical Safety Code")

Tentative American Standard

Building Exits Code
Safety Code for Ladders
Safety Code for the Protection of Industrial Workers in Foundries
Safety Code for Aeronautics
Safety Code for Automobile Headlighting —Laboratory Tests for Approval of Electric Headlighting Devices for Motor Vehicles
Safety Code for Automobile Brakes and Brake Testing
Safety Code for Woodworking Plants
Safety Code for Logging and Saw Mill Machinery
Safety Code for Pulp and Paper Mills
Safety Code for Laundry Machinery and Operations

Recommended American Practice

Safety Code for Forging and Hot Metal Stamping
Safety Code for Point of Operation Hazards of Rubber Mills and Calenders

Codes in one stage or another of formulation are as follows:

Safety Code for Construction Work
Safety Code for Floor and Wall Openings, Railings and Toe Boards
Safety Code for Walkway Surfaces
Safety Code for Window Washing
Safety Code for Mechanical Refrigeration
Safety Code for Machine Tools
Safety Code for Compressed Air Machinery
Safety Code for Conveyors and Conveying Machinery
Safety Code for Mechanical Power Control
Safety Code for Plate and Sheet Metal Working
Safety Code for Cranes, Derricks and Hoists
Code on Protection Against Lightning
Safety Code for Textiles
Safety Code for Tanneries
Safety Code for Industrial Sanitation
Safety Code for Exhaust Systems
Safety Code for Amusement Parks
Code on Colors for Gas Mask Canisters

The careful method of procedure outlined is calculated to result in the development of codes representing as nearly a full national consensus as is humanly possible; but it will readily be appreciated that the making of a code is only part of the code problem. If codes are to be of real value, they must be used as well as made.

PROMOTING THE USE OF NATIONAL SAFETY CODES

A very important part of the Safety Code Correlating Committee's work is, therefore, promoting the use of the national safety codes as developed. In carrying on this work, it is following a plan which is designed both to secure the widest possible publicity for the codes and to bring them directly to the attention of the principal agencies through which their use can be brought about—the states, the insurance companies and the industries.

The practice of the states in their efforts to promote accident prevention are far from uniform. Some states have statutory requirements for accident prevention; others have such requirements and a staff of factory inspectors to enforce them; others have a board, official or commission with power to make detailed regulations, usually with reference to only one subject or industry; and still others

have officials or commissions with power to make detailed regulations for industries in general and with a staff of inspectors to enforce both statutory requirements and commission orders. Through the kindly offices of the United States Bureau of Labor Statistics, all codes as completed are printed, except where the sponsor for a code desires to do the printing, and are brought to the attention of the authorities having to do with accident prevention in the several states. The codes are thus put into a position to receive consideration in connection with whatever practice is followed by a state in its accident prevention work. Practical results from such consideration are naturally slow in being realized, and the extent to which these results go vary.

THE EXTENT OF THE ADOPTION OF NATIONAL SAFETY CODES

Replies to a questionnaire sent out by the Bureau of Labor Statistics in 1926 to ascertain to what extent the states were making use of the national safety codes, or were formally adopting them, showed that the codes had received favorable attention in quite a number of instances. New Jersey was pursuing the policy of adopting all the national safety codes as developed, and of revising in conformity with them such codes of its own as had been previously formulated. All the safety standards of Wyoming were those covered in national codes. Utah had adopted in full several of the national codes and in part a number of others. Tennessee had adopted a number of safety codes, in the making of which the provisions of the national safety codes had received full consideration. In Montana, none of the national codes had been formally adopted, but state requirements were substantially the same as those of the codes. New York coördinated its codes with the national codes so far as possible. Pennsylvania's policy was to adopt national codes whenever the provisions were applicable to conditions in Pennsylvania. California had not yet used the national codes as a basis of any orders adopted by the state commission but planned as revisions were undertaken to study the codes carefully and adopt the national standards whenever possible. Massachusetts was giving full consideration to the provisions of national codes in adopting rules for its accident prevention work. Wisconsin was planning in the revision of its general safety orders to make use of all the national codes applicable to Wisconsin conditions.

Several of the other states, while not adopting any of the national codes, have either made rules which, though not so detailed, are substantially the same as the provisions of the national codes, or have instructed their inspectors to be guided by these codes in carrying on their accident prevention work in the industries of the states. The Bureau of Labor Statistics sent out another questionnaire in 1927, and it is reasonable to expect that when the replies are all in, they will show even more favorable results.

The National Bureau of Casualty and Surety Underwriters has approved the national safety codes in principle, and specifically approves individual codes as rapidly as they are recommended to it by its engineering committee. When a specific code is so approved, the Bureau brings this code to the attention of its member companies, suggesting that each company instruct its inspectors and engineers to follow the provisions of the code in their work except where a different standard is required by state law or municipal ordinance or by the provisions of the Industrial Rating Sched-

ule. The National Association of Mutual Casualty Companies is giving consideration to a proposal emanating from its engineering committee that it take similar action. The advisability of the few differences between the industrial rating standards and the national codes being adjusted so that these will be in uniformity in all respects has been brought to the attention of the National Council on Compensation Insurance, which will undoubtedly give consideration to the matter when any revision of the industrial rating standards is undertaken.

General Publicity

The work of giving general publicity to the codes and bringing them to the attention of industry with a view to their voluntary adoption covers a broad field of effort. A considerable part of this work is being carried on by the National Safety Council through various activities. As each national code is approved, it or an article summarizing it is published in the *National Safety News*. A copy of the code is sent to each of the trade journals representing the industry to which the code applies, and the journal is urged to give all possible publicity to it. The Council writes to all national associations and organizations interested in the code, and to as many state and local associations as possible, urging them to give publicity to the code, and offering free copies for distribution among their local chapters or their members. The managers of the local councils throughout the country are urged to coöperate in promoting the adoption and use of the code by the industries in their territory naturally interested in it. Letters are sent to selected lists of Council members suggesting voluntary use of the standards of the code in their own plants.

In addition to this work by the National Safety Council, each member of a sectional committee developing a code is urged, when the code has been approved, to give all possible publicity to it, and particularly to bring it to the attention of the associations, local branches of associations and other organizations of which he may be a member. Engineering societies and other organizations which may have been concerned in the preparation of codes or may contemplate such preparation in the future are also urged to submit codes already prepared to the procedure of the American Engineering Standards Committee with a view to giving them the additional authority and appeal resulting from a national consensus, and to give consideration to national codes already prepared in the formulation of such codes as they may plan to undertake.

Progress of Development

It will readily be appreciated that the safety codes developed under the procedure of the American Engineering Standards Committee will necessarily be slow in reaching a truly national status—national in their use as well as in the method by which they are developed—but the Safety Code Correlating Committee believes that while the progress will be gradual, the forward movement cannot fail to reach its goal. It is practically inconceivable that codes developed through reaching a national consensus of all interests concerned can fail to command general respect and come into common use.

Importance of Adoption

From the point of view of the Safety Code Correlating Committee, the voluntary adoption of the codes by industry is perhaps the most important factor in reaching the desired end. The importance of safety work is

steadily becoming more and more appreciated by industry, not as an humanitarian side issue, but as an integral part of successful production. The cost of industrial accidents is no longer measured in terms of insurance premium or other direct outgo for compensation or indemnity according to law. That the so-called incidental costs amount to several times the direct outgo is clearly evident to a rapidly increasing number of industrialists.

Safety is, therefore, becoming a major, rather than a minor, consideration to the thinking employer, who seeks to give weight to every real factor affecting his success. A well-known steel man pictured the place of safety in industry very forcefully when he said of his own company: "Safety is just as much a part of operation as a blast furnace or an open hearth." And this is not an isolated instance. A recent scientific study, covering a wide range of industry, indicates plainly that the most productive plant is at the same time the safest plant.

The appeal of the national safety codes to industry is particularly strong because of industrial representatives having a direct part in their formulation. No recommendation could be stronger. This same reason commends the codes to state boards and commissions and to insurance bureaus and boards. Not only have they themselves had a full share in preparing the codes, but the participation of industry is convincing to them of the practicability of the code provisions as applied to industrial operations, in which they are just as much interested as industry itself.

It would seem, then, that in view of the large and fast increasing interest in accident prevention, and of the fact that national code projects are undertaken only when there is a real demand for them, and are formulated only through the taking of a national consensus, these codes need only the widest publicity among those directly interested in safety to bring about their widespread use.

Safety Standards in Industry

By W. Dean Keefer

Chief Engineer and Director, Industrial Division, National Safety Council

THE frequency and severity rates[1] of accidents in industry in the United States are on the decline if the results of a study recently completed by the National Safety Council can be accepted as typical of American industry as a whole.

For this study, the investigator secured the accident records of 687 companies in twelve industries for the two years 1925 and 1926. The joint frequency rate of these companies was decreased 7 per cent and the severity rate declined 9 per cent.

In spite of this progress, however, it is quite evident that still better records can be established, not only by these 687 companies, but more particularly by the remainder of the 196,000 manufacturing plants that are operating in this country, and that further progress depends upon the ability of industrial managers (1) to devise better and safer operating methods, and (2) to perfect their plans for teaching safety to the workers and their supervisors.

Before making any radical changes, it of course is necessary for the individual manager to study existing conditions and to determine in his own mind just what methods are now being used to the best advantage not only in his own plant, but also in the plants of his competitors. He will want to make sure that every available scrap of scientific and practical knowledge is at his disposal, that all suggested improvements are adaptable to existing conditions, and that each new expenditure can be justified by savings in production, operating efficiencies, or accident costs.

It is in this way that "standards" are developed, and fortunately the manager is saved a great deal of time and trouble because much of this standardization is being done for him (but with his coöperation) by the equipment and machinery manufacturers, his trade associations, various engineering societies, the American Engineering Standards Committee, and the National Safety Council. These and many other organizations are rendering a specific service that no manager can afford to ignore.

Standards for Equipment and Operating Methods

The American Engineering Standards Committee, for example, through its Safety Code Correlating Committee and its Mining Standardization Correlating Committee, has organized some fifty-five technical committees to study such subjects as ladders, grinding wheels, power presses, etc. The personnel of each of these technical committees includes a group of ten to forty experts representing the leading organizations of the country interested in the given subject, thus assuring the development of a report or code that is correct and comprehensive in every detail.

Progressive managers in all industries are working and coöperating in the formulation of these codes, and as

[1] Accident frequency rate is the number of lost time accidents per million hours worked.

Accident severity rate is the number of days lost due to accidents per thousand hours worked.

A lost time accident is an accident which causes death, permanent disability, or loss of time beyond the day or shift during which the accident occurred.

rapidly as a new one is completed it is adopted as an industrial standard to be used as a guide for engineers, superintendents, foremen, and others who have charge of industrial operations. As industrial equipment and operating methods are improved, these codes are revised, so that each code presents the new and up-to-date ideas that can be recommended for immediate adoption.

STANDARDS FOR SAFETY EDUCATION

Experience has shown that the standardization of industrial methods and equipment is extremely important in increasing production efficiency. It also helps in decreasing accidents and accident costs. Nevertheless, the safety education of supervisors and workers is equally effective and necessary. The standards for safety education, though not developed in code form, are as easily obtainable as are standards for industrial methods and equipment.

These educational standards particularly emphasize the need for employing or appointing one man to supervise the safety work in each plant. This man might be assigned such duties as investigating all accidents, supervising first aid, fire fighting and mine rescue work, keeping records of accidents and safety suggestions, making safety surveys, supervising safety committees, etc. Without a safety man, educational work among the supervisors and workers is likely to fail; success demands an organized plan well formulated and well supervised.

Emphasis is also given the necessity of selecting a sufficient number and the right type of supervisors who not only know the safe and efficient operating methods but who also have the ability to teach these methods to the men working under their supervision. In other words, organization has a great deal to do with the success of any educational program.

Supervisors must then be given an opportunity to hold meetings from time to time to discuss their common problems—and accident prevention in particular. They should have access to trade journals and safety publications to increase their own funds of information which can be passed on orally to the workers.

Educating workers in safety is a job which challenges the ingenuity and ability of every industrial manager and supervisor. New ideas are being developed continually and necessitate considerable flexibility in working out detailed plans. Yet certain activities have secured such substantial results that the underlying principles remain unchanged standards. Such activities include the use of safety posters, publication of a company magazine, the use of safety signs, rule books, suggestion systems, and classes in first aid, distribution of printed matter such as pay envelope enclosures, special letters, hand books and safety calendars, organization of safety committees, safety meetings, use of motion pictures, stereopticon slides, prizes and bonuses for safety, etc. Pamphlets on all of these and many other subjects can be secured from various insurance companies, state labor departments, the National Safety Council, and other organizations.

If the annual toll of accidents in industry is to be cut down to the point to which it should be cut, safety must be made an integral part of the operating procedure of each plant. Contrary to the interpretation that is often given the term, standardization does not retard progress. On the other hand, it automatically eliminates nonessential and worthless variation, pointing a directing finger toward development along correct and reasonable lines.

Performance Standards in Industry

By Joseph A. Piacitelli

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THE establishment and maintenance of standards are primary essentials in an installation of scientific management. They lie at the root of the planning and control of operation which serve as a basis of the scientific management of an industrial unit. The principles underlying such a system were set down by Taylor when he arrived at the conclusion that traditional methods of control and production must make way for systematic research towards the standardization of methods, materials, tools and the performance in accordance with the standards derived from the research.

Taylor's aim was to set piece rates, and in order to do this it was necessary to establish standards of performance which in turn required the complete standardization of methods, materials, quality of output and equipment including machines, tools, fixtures and pieces of equipment used for facilitating, handling, transporting or storing materials and the finished products.

This complete standardization of details and methods is not only desirable but absolutely indispensable as a preliminary to specifying the time in which each operation shall be done and then insisting that it shall be done within the time allowed.[1]

It is the purpose of this paper to discuss the fundamentals upon which performance standards are based, and to point out some of the important factors, controlling the setting of these standards, in such a way that they will serve advantageously the employee as well as the employer.

[1] "Shop Management," by Taylor.

Methods of Establishing Standards of Performance

There are several methods used to establish standards of performance, each having its own particular slant, and are known today as Time Study, Motion Study, Micromotion Study, Time and Motion Study, Job Analysis, Operation Study, etc. There is no doubt that their purpose is the same regardless of the name given them. The writer must say, however, that although their purpose may be the same, namely, that of establishing the best method of performing a certain operation and determining the time in which the worker is expected to perform it, they do not all produce the result in the degree of accuracy that may be desired. In this fact lies the difference between these various technics, which may be grouped into two classes, such as Time Study, Operation Study, and Job Analysis in one and Motion Study, Micromotion Study, and Time and Motion Study in another. For the sake of brevity the writer will discuss these two under the subjects of Time Study and Time and Motion Study, respectively.

In the former class all observations relative to methods, equipment, tools and surrounding conditions, or, in fact, anything that will have bearing on the job, are made with the naked eye. Time records are made by first standardizing the method and then breaking it up into subdivisions suitable for stop watch observation and finally, using such a timing device, the time for each subdivision is observed and recorded.

In the latter class a simultaneous record of the method and time, as well as the layout of equipment, machinery and tools is made with a motion picture film.

The time element is recorded by placing a clock in the field of the camera. The dial on this clock is graduated into 100 divisions and its hand makes 20 revolutions per minute, thus making it possible to read the time value in units of 1/2000 of a minute. Using this method of recording, advance standardization of the method is not necessary. Standardization follows the establishment of the best method which is the result of analysis. In the former, the time element is considered the most important factor towards the solution, while in the latter, the method employed receives the greatest emphasis. It must be remembered though, that regardless of the particular technic employed, both the time and method are considered.

In the opinion of the writer, how the work is done is the factor to be considered most important when studying a job, for it is the method that has the greatest effect on the standard set and the productivity of the worker. It is from this point of view that Gilbreth made his distinctive contribution to the field of management, for he found that a record of time required to perform a subdivision of an operation, generally short enough and suitable for stop watch observation, was valueless unless a simultaneous record of how the work was done during that period of time, brief as it may have been, is made. Gilbreth would not stop at merely standardizing the present method with the aim of finding out how long it took to perform the operation in accordance with that method, but saw the value of studying the best worker, improving on his method, if possible, and establishing the "One Best Way" of performing that operation with due consideration to the degree of perfection the savings will permit, and to the surrounding conditions, tools and equipment available.

Which of the technics described above should be used to establish standards of performance is determined largely by the characteristics of the job to be analyzed. For example, in a machine shop operation of which the handling time is only a small percentage of the total cycle time, it may be more important to make a thorough study of the machine feeds and speeds than to make any detailed analysis of the handling operations. In this case the analyst, who should be familiar enough with motion study, can satisfactorily dispense with the handling phase of the problem, by making a brief analysis of the motions involved, without the use of the film, and set the time standards for that part of the cycle with the aid of the stop watch. The major and more important part of this cycle will be a matter of the calculation of the best speeds and feeds of the machine, and the employment of the best tools available for that work. On the other hand, if the major part of the time of the complete cycle is devoted to handling operations, it then becomes important to pay the greatest attention to the motions involved in the method. It is, of course, obvious that when a method consists entirely of handling work, a detailed analysis of it is necessary.

The time required to perform one complete cycle, or, in other words, the number of times that cycle is repeated throughout the day is also to be considered; for instance, in a cycle lasting one hour of which the handling and set-up time is but five minutes, an error of say 20 per cent in the handling time is practically negligible when the time for the complete cycle is considered.

If, on the other hand, the cycle time is ten minutes of which five are devoted to handling operations, then, an error of 20 per cent would become a serious one, especially as in an eight-hour day, that cycle would be repeated 48 times.

In highly repetitive operations, which are performed thousands of times daily and especially those consisting entirely of handling work, the study of the motions made by the worker becomes more and more important. In these cases the use of a stop watch is of little value, for with it, the analyst must work under limitations which often make it impossible for him to make an accurate study, not only of the time, but the method employed as well. The time and motion study technic employing the use of a film, the cost of which is approximately two cents per second at standard filming speed, has certain advantages over the stop watch method regardless of duration of cycle or percentage of handling time. It is possible to make a fairly accurate stop watch time study of an operation, requring a reasonably long period of time to perform, but, as the operation time decreases, the recording of the data by such a method becomes more and more difficult. Meanwhile with the motion picture method it is no more difficult to record the time of 100 motions performed in one minute than it is to record their times if performed in ten minutes. With the use of a stop watch it is not practicable to time sub-operations lasting for periods less than three or two seconds, for below this time the error made in reading becomes a serious factor. There are many operations which require the services of more than one worker, and here again the limitations of the stop watch method are removed by using the motion picture and Gilbreth clock combination. Films have been taken of groups of workers employed on the same product, but each performing different operations, many of which overlapped, and successfully analyzed as one complete job, and all the desirable results expected from the analysis of any individual operation have been obtained.

WHO SHOULD ANALYZE?

The question of who is best fitted to make the study of an operation is one that is very much discussed. It does not matter whether or not the analyst is called a time study engineer, methods research engineer, industrial psychologist, or industrial engineer, so long as he is equipped with the necessary knowledge which will enable him to make a just and intelligent analysis of the problem. Each of them must have a fair knowledge of psychology and physiology, thus enabling him to deal with the human element, and must above all have a thorough foundation along engineering lines, in order that he may analyze the work from the technical standpoint and improve the methods to the highest degree practical by the introduction of machinery whenever it is economical to do so. The psychologist cannot succeed unless he is familiar with industrial practice, designing of machinery and tools. On the other hand, the engineer's success is also limited, unless he has a practical knowledge of the human element.

The aim of every analyst, regardless of title, should be to reduce cost, increase wages of the worker and make the job easier. The results obtained will depend in a great measure upon the research ability, background and experience of the analyst. These methods of analyzing work are merely tools aiding the analyst, some of which, of course, may be better suited for certain kinds of work than the other, but the results obtained will depend upon the way in which they are used.

SELECTING THE OPERATION

Except in cases where a complete installation of scientific management is being made, in which case each operation must be thoroughly investigated and standards of performance set as a prerequisite to efficient planning, the question of what operation is to be studied first is one that very often faces the analyst. This condition usually exists in plants where the planning and control of production has not already been established in accordance with the principles laid down by Taylor, although there is no doubt that there are many plants today employing these principles in spite of the fact that no complete installation of scientific management has been made. Generally the operation to be studied is pointed at by the management for reasons such as high unit cost of production, excessive waste or failure to produce a desired quantity within given units of time. Other factors pointing to operations requiring the attention of the analyst are: fatiguing elements involved in the method of an operation, delays caused on one operation because of the slowness of another previous to that, or defective transportation system, thus delaying the arrival of material at the work place. In plants where large machines are used in production, such as paper mills, roofing plants, etc., it is always best to tackle first, the operation limiting the production of the whole unit in order that the greatest amount of service will be rendered by the machinery.

CHOOSING THE OPERATOR

Once the operation is selected the analyst must decide on the grade of operator whose work is to be studied when more than one operator is employed on the same kind of work. Many opinions are held as to who should be studied in such cases.

While some of the investigators employing the Time Study technic select the worker whose performance is somewhat better than the average, most of them consider the average or standard worker, or rather, the man whose output represents the average performance of the department as the best subject. Their practice is based on the opinion that if a standard is established using the average worker as a subject, it can be considered fair and just with respect to the performance of the other workers in the group. The slow worker will not produce fast enough to set a proper standard, while the superstandard or highly skilled worker will give a cycle time which cannot easily be realized by other workers. From this point of view, then, the superstandard worker is of no additional value to the management, other than the extra work turned out by him. This class of worker is sometimes used as a subject and allowances made for differences in skill. At this point, the technic of motion study differs greatly from that of time study for, the most desirable feature of the motion study technic is that it makes the analysis of the performance of any worker useful regardless of the method and time; provides the means of making an analytical study of the best workers; and lastly, makes possible the transfer of the composite best method to the others. The performance of the best workers should be studied, improved if possible, and the method transferred to others with allowances for the beginners, until the desired automaticity is acquired.

The time and motion study analyst, making a photographic record of a job, is not only interested in the best man from the point of view of production, but also in the worker whose method appears to be the least fatiguing. Much can be learned from this latter

type of worker, for although he may not produce as much as the best man, his method when analyzed, motion for motion, may have greater possibilities. In such cases the difference in production is very often due to strenuosity rather than efficiency.

There are many psychological factors which must be considered when the study is inaugurated in order that the coöperation of the worker be received. The methods employed by the investigator to handle this particular situation usually have great bearing on the outcome of the study. The most desirable thing to do is to make every attempt to put the worker in the spirit of research by carefully explaining to him the purpose of the study, and enlisting his coöperation to arrive at the best solution. He must not only be considered an investigator, but must also be rewarded as such by guaranteeing him the maximum earnings based on his past performance in order that his income will not be affected by the loss of production due to interruptions during the investigation. If the psychology of the situation permits, the worker should receive extra pay during the period of research and installation of the new method, for, when subjected to these conditions to which he is not accustomed, especially in connection with trying methods in which he does not have automaticity, the worker is more fatigued than usual.

Recording Existing Conditions

Much has already been said about the methods used to record the existing conditions, and it has already been pointed out that it is usually most desirable to make a simultaneous record of the method and time, equipment and tools and their relation to the worker. The degree of detail with which a study may be made will depend largely upon the repetitiveness of the operation or the duration of one cycle. In cases where an operation does not consist entirely of handling work, and if the length of the cycle is such that it will make the filming of the complete cycle prohibitive, then it would be wise to make a motion picture record of the handling work only, omitting the filming of the activities of the operator during that part of the cycle in which he waits for the machine to complete its function. However, it is very necessary that we have a complete record of the operation, and this can be done quite effectively by making a process chart,[2] from the point of view of the motions of the worker in the degree of detail that may be considered necessary.

In such cases the stop watch should be used to determine the time required to perform those parts of the operation which do not appear in the film. By this procedure we will have a record of the method in process chart form and data pertaining to the time element. Although these records were not made simultaneously, as would be the case with the use of the film, they will serve the purpose for which they were made.

Aside from the film it is usually advisable to make sketches of the layout of the work place and equipment, which will be of value when the analysis is being made. Stereoscopic photographs are sometimes desirable in making the record of the job complete. A written record of the surrounding conditions, such as lighting, temperature, glare, dust, smoke, shadows, ventilation, or any other factors effecting the productivity of the worker should be made. If necessary, records should also be made pertaining to the physical characteristics, personality,

[2] Process Charts, by F. B. and L. M. Gilbreth, American Society of Mechanical Engineers Transaction, 1921, Vol. 43.

schooling and training of the worker. Any number or all of these qualties may be listed. In some work it may even be desirable to make a psychological test in order that data will be available which would enable the analyst to discover, if possible, any outstanding mental qualities in the worker-investigator.

ANALYZING DATA

It does not usually require a person of high calibre to make a record of the conditions, but, when this data is reduced to some visual form, or properly tabulated, as in the case of time studies made with a stop watch, its analysis calls for the person best equipped along the lines such as have been described in one of the foregoing paragraphs.

In establishing the standard time from a tabulated record of stop watch observations, including data relative to the time required to perform the various subdivisions of the operation as well as time lost due to delay, the investigator selects the time which, in his opinion, represents a fair performance. Some use the average time as the basis for their standard while others use the selected minimum, median, mode or geometric mean. Generally the abnormal readings are eliminated. The unusually short times are disregarded primarily for the reason that they are probably due to errors in reading, or observing. The long times also are discarded because of the probability of the worker's slowing down on account of some condition which the observer did not note when making his records.

From the point of view of the time and motion study investigator the short times, the accuracy of which is not doubted, receive more attention than others, because he is interested, not only in the time required to perform the suboperations, but is endeavoring to find the best way of doing the work. Therefore, the presence of these short times provides the means of discovering and analyzing a higher degree of skill. Quite often this difference in time is due to slight variations in the method which may not be easily noticed with the naked eye.

With the motion picture and clock combination it is possible to study a method very minutely. To do this Gilbreth revealed the existence of seventeen elements of motion (Therbligs)[3] and has shown how these elements may be used in analyzing any productive activity. When more than one cycle is recorded, as would be the case of those of short duration, the time for each Therblig in the various cycles is transferred from the film to, and tabulated on, a sheet similar to that of the time study data sheet. Continuous clock readings are recorded marking the beginning of each Therblig performed by the left and right hand. From these readings the elapsed time for each successive element is recorded. Representative cycles of each method, especially when more than one operator is filmed, are charted on Simo charts[4] which enable the analyst to visualize the duration and sequence of each element of motion in the complete cycle performed by each hand of the operators. Any useful activity of other parts of the body is also included in these visual records. Variations in the method, either due to different cycles or performance of different operators thus recorded, make it possible to select the least fatiguing elements in any part of the cycle. Motions which are apparently unnecessary are eliminated while the necessary ones are facilitated and every effort is made

[3] "Applied Motion Study," by Gilbreth.

[4] Silmultaneous Motion Cycle Chart, by Gilbreth, Management Handbook.

to reorganize the work so that the avoidable delays are eliminated and those unavoidable reduced. These selected elements are arranged in their best sequence with due consideration to the physiological factors involved and the principles of the ideal execution of hand motions[5] set down by the Gilbreth organization. From these data a synthesis of the best method is made embodying the selected parts of the cycle, the elements of which were performed in the minimum time.

Very few methods have been studied and the "One Best Way" established without the introduction of fatigue-reducing devices, such as new machinery, tools, etc., leaving the worker more effective in his efforts or eliminating motions which would otherwise be necessary. The rearrangement of tools and equipment at the work place from the point of view of the areas described by the normal arc made by the arm motions of the worker also influences the solution. These modifications present the analyst with a new condition—that of determining the time for the desirable parts of the synthesized cycle of which no accurate data is at hand, and which must be obtained through other means. However, when this new condition is fulfilled the final synthesized cycle will consist of data from various sources and which may be divided into the following classes:

a. Information taken directly from film and the time value used as recorded.
b. Modified time data of identical elements if the performance of that element is facilitated in any way that effects time.
c. Data taken from simultaneous motions of other workers in case two or more workers are employed on the same piece and the worker under consideration temporarily moves out of the picture.
d. Time data transferred from records of work of similar nature.
e. Time data established in the laboratory for the particular element for which the time required is not known, and,
f. That which is estimated on the basis of past experience on similar work.

The method resulting from the consideration of the above factors will represent the combined skill of the operators studied plus the results of scientific investigation.

In such cases as those where the proposed method represents a radical departure from the existing conditions it is important that the data included in the proposed method be accurate enough to permit the analyst to calculate the probable performance in advance in order that the worthwhileness of new machinery, tools, etc., may be determined. This must be done, for upon these data and knowledge of possible improvement will depend the amount of money that the management can afford to spend. The expenditure must be justified by the savings.

ALLOWANCES

The minimum cycle time as shown on the synthesized Simo chart merely represents the amount of time in which that complete cycle can be performed. It indicates the best performance that can be attained with the proposed method. This rate of doing work can, for a short period of time, be demonstrated by a worker who has acquired the necessary degree of automaticity in the new method, but it cannot be expected from him as an average performance throughout the day. It is necessary then to make allowances for fatigue, oiling and cleaning of machinery if not done on day rate, and other factors which are not within the control of the worker. Some of these are, delays due to breakdown of ma-

[5] Management Handbook, Ronald Press Co.

chinery, lack of power or lack of materials to be worked. Space does not permit the complete enumeration and discussion of these various factors, but proper allowances, depending upon the characteristics of the work, must be made in order that the operator can work in accordance with the standard set and can do so continuously without excessive fatigue.

PERFORMANCE STANDARDS IN CONTINUOUS PROCESS WORK AND IN JOB SHOPS

In continuous process work the standards are based on the performance of complete units. If the rate of performance of these units is within the control of the operators the standard is usually based on the average speed maintained throughout the day. On the other hand, if the speed is fixed as in case of paper making machines, then the standard of performance may be expressed in terms of number of hours they are kept in operation in proportion to the maximum within a given period.

In some of the early installations of scientific management stop watch time study standards have been compiled covering a variety of elementary operations such as "Pick up clamp", "Put clamp in position", etc. With these records of past performance the planning department can determine in advance the time required for a complete operation consisting of any number of elementary operations.

In jobbing work when the approximate time required to complete a lot does not permit a thorough analysis of the work the standards are generally set on the basis of experience with work of a similar nature. The engineer setting these standards must not only have a knowledge of the particular class of work with which he is dealing but must also have a good understanding of the principles of motion study. With such a foundation he will be able to prescribe the most effective method and determine the best layout of the work place. The method may be set down in the form of a simple Simo chart showing the sequence of the elements of motion to be performed by the hands and the time required for each. This data is given to the foreman who sees to it that the work place is set up, work started, and completed in accordance with the standard predetermined. This technic is now being successfully employed in a large New England manufactory.

TEACHING NEW METHODS

One of the most valuable results of the establishment of a best method and its standardization by means of time and motion study is the ease with which the skill represented by the new method can be transferred to other workers. When teaching the new method it is necessary to show it not only in terms of sub-operations, but it is very important that the elements of motion making up each sub-operation, their sequence and the relative times required for each, be given. Skill cannot be transferred with any degree of effectiveness unless the worker can identify the new method Therblig for Therblig. This can best be done with the aid of a motion picture of the new method as performed by the worker studied.

There are, undoubtedly, persons who learn much more quickly by seeing the new method demonstrated, while others prefer some static visual record of the complete cycle such as the Simo chart. Some would profit most by reading a description of the method written in the necessary degree of detail, while still another type will gain more by hearing about it. However, no time should be spent investigating

the individual mental differences to determine which of these means is best for each person. The information must be given in every way feasible, that is: by written instructions (instruction cards), lectures, photos, motion pictures, charts and actual demonstration, so that regardless of his mental characteristics, the worker will get it in the way best suited to him.

EFFECT OF STUDIES ON THE WORKER

Since performance standards and incentive systems go hand in hand it is important that the earnings of the worker at standard performance receives careful attention. Although the standard is set on the basis of effort its success will depend very much on the fairness of the wages paid with due consideration to the going wages of the vicinity and the many other factors consistent with good practice.

Usually, these studies result in savings of which the worker receives his share. Now, just what part of the total savings he receives will depend on his earnings before the study. If he was well paid then a small increase at standard performance will be satisfactory, while on the other hand, if the worker was underpaid, his earnings will be increased to an adequate wage. Operations on which fatigue has been reduced and on which no saving in unit cost has been made because of the output not being within his control the operator benefits by the reduction in energy required to do the same amount of work.

When a study results in a reduction in the number of workers to do a given amount of work then every attempt must be made on the part of the management to keep those workers displaced by the improved conditions on the payroll, by giving them work in other parts of the organization.

MAINTAINING PERFORMANCE STANDARDS

Once the performance standards are set and made effective, steps must be taken to maintain and keep them up to date by a periodic inspection of the methods, tools and equipment upon which they are based. The management should frequently check up these standards for the possibilities of improving them through the introduction of machinery and tools which were not available at the time the standards were originally set. An increase in volume of business with respect to a certain product will also call for the attention of the analyst to determine whether or not it is permissible to use expensive machinery which was prohibited by insufficient savings at the time the last analysis was made.

The methods herein outlined are being applied with success in analyzing productive work in the Industrial and Commercial fields. Research is being constantly carried on to maintain their effectiveness in the new and changing conditions and to broaden their scope, by engineers engaged in this work and by the Gilbreth Research Group of which the writer is a member.

Smoothing the Wrinkles from Management

Time Study the Tool

By Sanford E. Thompson

President, The Thompson Lichtner Co., Inc. Engineers, Boston, Mass.[1]

THE modern executive is appreciating the fact that time standards are of major import in management, that the manner in which these are handled frequently means a difference between profit and loss in his balance sheet and a choice between contented workmen and labor unrest.

The use of time study is spreading rapidly—more rapidly perhaps than a thorough understanding of its principles. Lack of appreciation of its importance on the part of the chief executives is leading, on the one hand, to the hiring of inexperienced young men to handle a job that requires experience and judgment, and, on the other hand, to engaging of service vendors to introduce a "system" dealing simply with the placing of a piece price upon a job without regard to its manner of performance or to its setting in the business as a whole.

The improvement of any business, whatever its nature, requires a broad treatment dealing with finance, marketing, budgeting, master planning, inventories, production control, standardization, wage determinations, and cost control. The development of time standards is only one element in the broad improvement program, an element of vital importance, but it should not be treated independently nor to the exclusion of the other elements, but from a broad conception which includes, allows for and develops all aspects.

[1] Presented before the Taylor Society, December, 1927.

Results of Time Standards

Time standards, properly developed through time or motion study:

1. Reduce labor cost through a higher and more uniform rate of production.
2. Reduce idle time of men and machines through the accurate planning made possible.
3. Maintain, insure or improve quality by aiding in the adoption of uniform and best methods.
4. Aid sales by providing accurate knowledge of labor costs.
5. Improve labor conditions and decrease turnover by giving a square deal and increased earnings to the worker.

Purpose of This Paper

This paper is designed, first, to present fundamental principles and practical methods of using time studies in the various functions of a business, and, second, to show specifically the place in industry of time measurement and job analysis as a tool of management.

It is not assumed for a moment that time study is a cure-all for irregularities in management—that its use can smooth out all the "wrinkles." In a machine shop, for example, the establishment of standards of feed and speed may precede time study to good advantage. In a pulp or paper mill, the process standards are more important than time standards and result in reduction of labor and easier performance. Time study further as-

sists, however, in obtaining and maintaining process standards. Furthermore, it is apparent that the basic principles of time analysis, that is, the consideration of the elements of any problem, whether it be in process, or machinery, or men, form the basis of our wonderful present-day developments along research lines.

Time study is often looked upon simply as a mechanism for setting piece rates. Determination of standard times for fixing incentives is of great value. Time study has, however, a still broader use, which is insufficiently recognized, and this is as a tool for the development and operation of controls, so as to know what is a standard day's work, and to obtain this standard from each machine and work place, thus reaching a maximum production from a minimum of equipment and personnel. The by-product of this is a highly productive and *highly paid* personnel. Treatment of the subject, therefore, must include these factors as well as the usefulness of time standards in fixing selling price.

TIME STUDY IN BUSINESS MANAGEMENT

The field of time and motion study and its effect upon a business as a whole is scarcely appreciated, even in the more modern plants. Illustrations in later paragraphs are of particular interest in showing what an important tool time study can be made in practical plant operation from the standpoint both of economy and labor.

The two most important uses of accurate time standards are:

1. Fixing of measures for incentives that:
   - Accurately balance different operations.
   - Insure best methods of operation.
   - Provide for ease of performance.
   - Promote uniformity of quality of product.
2. Production control where they are utilized in coördination of number of operatives with production or coördination of production with number of operatives. This results in:
   - A minimum of idle time of operatives and machines.
   - Shortest time in process.
   - Delivery of goods on schedule.
   - Reduced cost.
   - Increased earnings of operatives.

In addition to these principal uses, accurate time standards are essential to the establishment of accurate cost standards in the manufacturing of complicated products or a variety of styles.

To accomplish satisfactory results in these various features true time study must be based on certain essential principles. The so-called time study, so frequently employed, which does not follow these requirements, is entirely inadequate to accomplish these purposes.

ESSENTIAL PRINCIPLES OF TIME STUDY[2]

There are certain fundamental principles of time study analysis which are of universal application. The disregard of any one of these principles almost inevitably will destroy the value of the time study:

1. The prime purpose of time study is to enlarge production effectiveness through improved methods and thereby to increase returns to the individual worker.

[2] For complete and comprehensive information on time study principles, methods and results, see "Time Study and Job Analysis," by William O. Lichtner, Ronald Press, New York, and "Time Studies as a Basis for Rate Setting," by Dwight V. Merrick, Engineering Magazine Co., New York.

2. Time study must be practiced as a settled policy through a man or department not controlled by departmental foremen.
3. Time studies must be made always with the knowledge and coöperation of the operative observed. If practiced secretly, they are subversive of morale and futile in results.
4. Tools and machines must be standardized in advance of or in conjunction with time analysis, if such standardization has not already been accomplished.
5. Methods of performing each operation and the quality of workmanship must be studied and recorded, as well as the times. Time studies which disregard methods are of little value.
6. The stop watch should be run continuously and all delays recorded and described in addition to recording the effective times.
7. Studies must be made of the time elements of each operation, divided into small enough units to utilize them in various combinations.
8. Enough operatives must be observed to obtain fair average time standards, and before utilizing the data, continuous check production studies should be made, where possible lasting several hours.
9. A more expert handling—a more careful training, and a greater intelligence—is required for the analysis of studies and the establishment of standards than for taking the studies themselves.
10. It is important that records should be intelligible to persons other than the original recorder and that they should be available for the inspection of those interested.

These essential principles in general are self-explanatory and their importance is evident. The points enumerated are taken up in subsequent parts of this paper.

PRINCIPLES OF UNIT TIMES

As long ago as 1885, Frederick W. Taylor developed the principle of unit times. That is, the breaking up of an operation into motions or elements which can be used for re-combination into various other operations in the same way that the twenty-six letters of the alphabet in different combinations may be made to spell many thousands of words. Notwithstanding the time that has elapsed—over forty years since this discovery by Taylor—it is astounding how few time studies are made in such a way that they can be utilized properly. In other words, the vast majority of so-called time studies, even at the present time, simply record the total time of the single operation observed, with no thought of the best method, with no analysis of delays and with no recording of the elements of which the operation is composed. With this in mind, it will be of interest, after briefly discussing the present state of the art, to give one or two elementary illustrations of the practical application of unit times.

The principal illustration will be from the shoe industry. While this industry is one of the oldest in the use of incentives, and piece work is nearly universal, we venture to say that of all the shoe factories in this country, the concerns that set piece rates by any other means than guess and comparison—those who really consider the correct time for each element of an operation—number a very small fraction of one per cent. And yet it is the utilization of these unit time elements that makes it possible not only to eliminate the irregularities in piece rates, give

the workers a fair deal, and fix incentives on new styles, but it also, as we will show, provides a correct basis for determining the number of personnel for any required production and the most economical layout of work.

THE CRIME OF IMPROPER TIME STUDY

The vast majority of piece rates or other incentives, even at the present day, are set by guess or estimate. A common plan is to simply time the operations as they are going on, without regard to the method, thus neglecting the opportunity to effect large cost reductions through improvement in method and preparing the way for irregular, abnormal earnings. Another plan is to take simply over-all times without analysis into units so that new times have to be taken for every new job. Still another plan, quite common, is to time the operation very carefully into units or elements and then not use these elements at all.

In shop after shop also, even now the rates are set by the judgment of the foreman, based on approximate records or on tests under abnormal conditions, checked possibly by inaccurate times which the foreman takes from a stop watch carried in his pocket.

As an illustration of a really common method of rate setting, I was in Holyoke not long ago, talking with a young man in a paper products factory, and I asked him how the piece rates were set. He looked at me rather humorously—he had taken an industrial course at college—and said,

> Well, the foreman looks over the past records and sees what has been done on similar jobs and then he figures it up and thinks it over. He considers what he thinks he could do if he were performing the operation and then sets a rate. If the men kick like hell, then we know that the rate is right.

To show what a textile mill foreman honestly thinks is the proper way to set piece rates, I quote from an article in *Textile World* of September, 1927, entitled, "Uniform Piece-Work Rates. Studies by Foreman Result in Fair Rates." [3]

> It is not difficult to establish uniform piece-work rates. The foreman can time operations at the various machines. This is usually done by forcing production at certain machines and when production is at its height, securing the time of the operator without his knowing it.
>
> It is very important that the employes be unaware of the timing, or they are apt to slow down production, thus defeating the purpose of the timing. By using the timing process, uniform rates can be established, and every piece-worker then has an equal opportunity of making a living wage depending upon his individual skill.

No wonder, with such practices as this—and unfortunately this represents actual practice in many plants—time study is often misunderstood and condemned.

But even where the foreman does have a clear idea of what he is driving at, he simply cannot be expected to handle a specialized thing like time study or the fixing of incentives with satisfaction. Inaccuracies such as are always incident to this kind of rate setting were illustrated in a garment shop recently. The factory in question manufactures coats, and the operation of "making" was on piecework. The plant was fairly well managed. In examining the operations before making time studies to set accurate incentives and also to use in planning the work, discrepancies such as these were found: On five principal operations, the operatives worked from 77 per cent to 92 per cent of the hours they were in the plant, waiting the rest of the time. Any planning data based on earnings and hours would have been inaccurate

[3] By Harry E. Kaemmer.

in total from 8 per cent to 23 per cent, and, when the irregularities of the individual piece rates were also considered, there would be discrepancies of as much as 50 per cent.

In a plant in another industry, the piece rate on a new style was carefully estimated by an intelligent foreman. In spite of this the operative earned a little more than double the hourly rate the foreman figured he should earn. In other words, the foreman's careful estimate of the time standard was over 100 per cent high. Such estimates as these are just as likely to be wrong in the other direction.

There is another type of so-called time standardization that frequently is carried on as a fixed policy. The purpose is to set rates quickly, but it results not only in inaccurate times, but in necessity of timing the operations on every new style or part, instead of utilizing the unit times obtained by thorough analytical study to quickly set the new time. These "get rich quick" methods make no note of the method of performing the operation, make arbitrary allowance for the speed of the operator, rely entirely on judgment to fix the allowance and set up new independent times for each job.

This scheme had been in operation in a plant making machinery of complicated and diverse design requiring an immense diversity of small parts, many of them made up very infrequently. When an order for a new part came along, instead of utilizing data on file, one of the time study men would go out to the operative and take an observation on the first part of a lot which might occupy the worker from less than one to three days. From these few studies on this one man, he would set a rate, guessing at the proper allowance for rest and the variation in speed of the worker from the average. The results were, as would be expected, a heterogeneous set of times and rates, with no uniformity. For example, in checking the so-called standards, it was found that two machine parts, precisely alike but carrying different numbers because belonging on different parts of a machine, were given at different times, separate piece prices differing by 25 per cent. In other words, two identical operations were "standardized" at different times, with 25 per cent variation in the rate.

True, this type of standard setting begins to show results immediately, but it never comes to an end. On the other hand, the methods which give accurate results are simple and scientific and, taken all in all, require much less time and labor, and, as time goes on, reduce the time study work to a minimum.

A discussion of improper methods is scarcely complete without reference to certain practices of employers which fortunately are growing infrequent, of using time study for undue speeding up. As a matter of fact, in practice such purposes soon defeat themselves. On the other hand, the stop watch is an effective tool for labor coöperation, because through it, facts may be established that cannot be gainsaid. In practice, contrary to common belief, it is the workman who appreciates, even more quickly than the employer, the value to him of real time study and who can gauge the correctness of its operation.

ILLUSTRATION OF FIXING TIME STANDARDS IN A SHOE SHOP

Because of the vital importance of understanding the fundamental principles of unit times, let us take up a special case in rather elementary fashion.

The operation is one in shoe making called "hand folding." In various

parts of a shoe, the raw edge of the leather, after skiving to a tapering edge (another operation), is cemented, turned back over itself by hand, and sealed with blows of a hammer to show a neatly rounded edge. At sharp curves or angles, the edge has to be clipped or "snipped" to make the curve. In Figure I are shown pieces of leather on four different styles of shoes. One is a top, another is a tongue, a third a tongue of a different style of shoe, and the fourth is another top quite different in style.

3. *Fold*, a constant time per inch of edge to be folded.
4. *Pick*, a constant time to pick in and smooth a convex curve of 90 per cent or less.
5. *Handle*, which covers the laying aside of a complete piece and placing the next piece ready to be folded.

The following table gives the unit times on each of the four pieces shown in Figure II.[4]

Notice that in No. 1 there are only three operations, Handle, Cement and

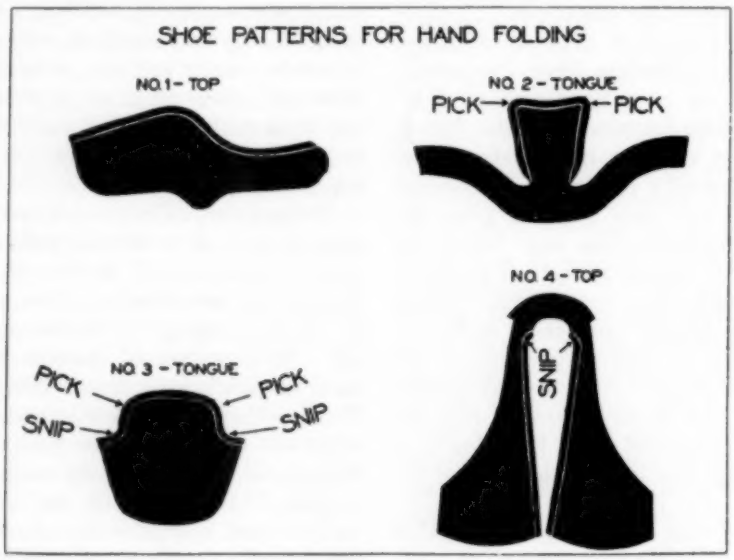

FIG. I

In making each of these varied pieces, and in fact for all hand folding, there are just five elements or units which make up the operation.

These elements are:

1. *Cement*, the time for which is taken from a standard curve made up from time study so as to give the variations in time according to the length of fold.
2. *Snip*, a constant time for each concave curve.

Fold, with a total time of 0.381 minutes.

In No. 2, we have Handle, Cement, Fold and also Pick, with a total time of 0.476 minutes. In other words, in this case, in order to get the leather round the corner, the tool had to be used to make the necessary puckers.

[4] These samples are four actual cases out of some three hundred different folding jobs in a particular shoe shop. To avoid unjustified comparison, however, the unit times have been altered and cannot be checked against actual or standard times in any factory.

STANDARD TIMES ON HAND FOLDING [4]

No. 1—Top	No. 2—Tongue	No. 3—Tongue	No. 4—Top
Minutes	Minutes	Minutes	Minutes
0.068 Cement 8″	0.062 Cement 6″	0.059 Cement 5″	0.077 Cement 12″
0.093 Handle	0.093 Handle	0.093 Handle	0.093 Handle
		0.114 Two Snips	0.114 Two Snips
0.220 Fold 8″	0.165 Fold 6″	0.138 Fold 5″	0.330 Fold 12″
	0.156 Two Picks	0.156 Two Picks	
0.381 Total	0.476 Total	0.560 Total	0.614 Total

In No. 3, there are two Picks and two Snips. In a snip the edge of the leather at the convex curve is nicked every one eighth inch, so the edge can be folded back on itself. The total time here is 0.560 minutes.

In No. 4, although there is no picking, since there is no interior corner, the total time is 0.614 minutes because of the extra length to cement and to fold.

Now, as has been said, each of these total times, and, in fact, the times of some 300 different styles of pieces, in this one shoe shop, are made up from a combination of these five elements. When a new style of shoe comes in, it is simply necessary to select from the basic curves and tables the unit time for the new shape and add the figures together. It is evident, on the other hand, that it is absolutely impossible to estimate the time for a new style from simple inspection of the piece, and yet this is the way that rates are fixed in most shoe shops as well as in many other industries. Haphazardly, either the foreman fixes the rate, without regard to the time element, or else the foreman and a representative of the

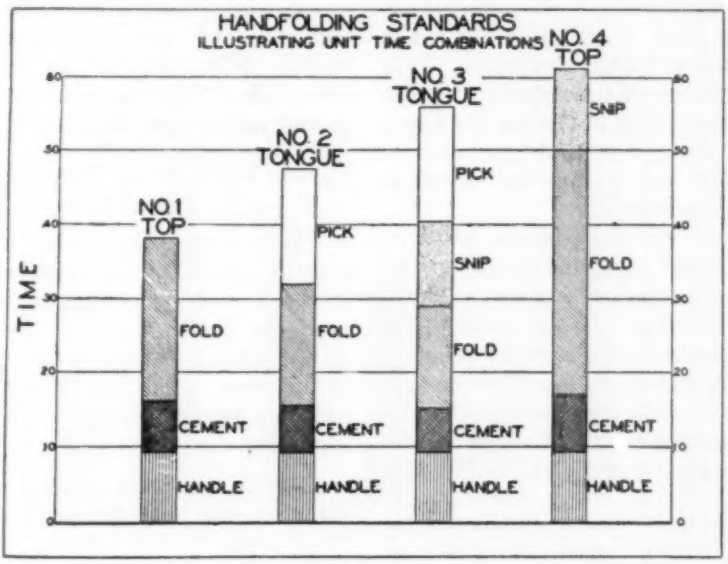

FIG. II

workmen get together and haggle over the matter.

The unit time method we have described, on the other hand, represents clearly the value of accurate time study in providing for variations in character of work and for setting incentives.

TIME STANDARDS IN PRODUCTION CONTROL [5]

The use of time and motion study as a broad gauge tool of management, as well as for the purpose of rate fixing, is only beginning to be recognized. Mention has been made of this broader use as it relates to managerial control although the treatment thus far has chiefly considered the operation of time and motion study in the determination of the standards themselves. The setting of incentives is only one of the uses for exact time standards; of equal importance are other uses in planning production so that manufacturing schedules will really fit the factory force and equipment, in determining the proper number of employes for given schedule, in evaluating quality, in developing best methods of operating and in determining labor costs to use in fixing sales prices. It is in the relation of time study to these features as well as in the use for fixing accurate incentives that its value is evident in smoothing the wrinkles from management.

The lack of appreciation, even in otherwise well regulated shops, of the time element in planning and scheduling is astounding. In our contact with various plants throughout the country, we find that most of them have certain elements of what is essentially "Scientific Management," although many would scorn to recognize it by this term. We find, for example, that many of the up-to-date shops, and especially the larger ones, have the materials well under control with running inventories substantially identical with the "Balance of Stores" originated by Taylor; we find the fundamental principles of planning the work; we find manufacturing orders made out in fair shape and a certain amount of planned control in most of these plants. Yet, in case after case there is the serious lack of this "time" element in planning. In other words, in making out a manufacturing schedule, there is practically no study made to see whether the time capacity of all important machines and men is equal to the task required.

This disregard of the time element produces a lack of coördination, which in turn causes many of the troubles which result in congestion in certain departments or work places with famine in others, in the excess or shortage of employees on different operations, in unnecessary time in process and in a consequent failure to make deliveries on schedule time. Idle time of machines or of operatives either from waiting or from slowing up the work is inevitable. This means also increase in unit costs of production.

EFFECT OF LACK OF TIME STANDARDS IN PLANNING PRODUCTION

To overcome this delay and lost time, which is particularly noticeable in plants making complicated lines of products, the time element must form an important feature in the planning of the work. The need of time standards can best be illustrated by actual examples:

CASE NO. 1.—The forge shop of a plant manufacturing large complicated machinery of many styles and types. Its specifications were well laid out; its materials under good control, but the varieties of the

[5] For a practical treatment of production control see "Planned Control," by William O. Lichtner, published by the Ronald Press, New York.

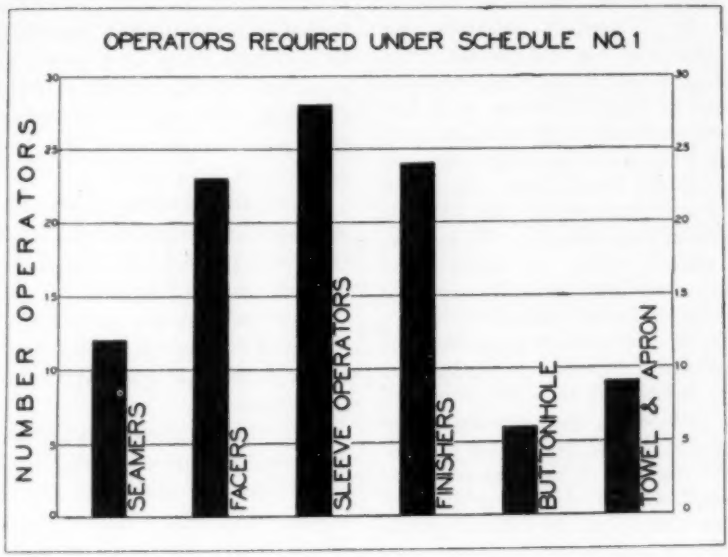

FIG. III

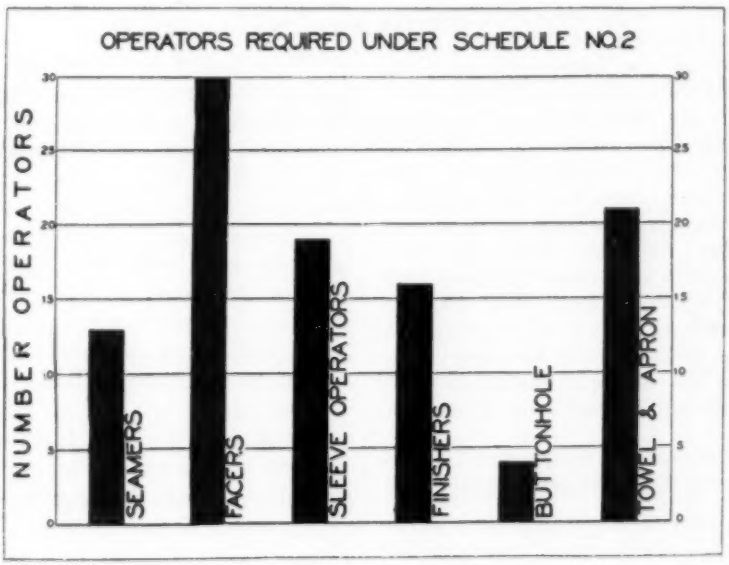

FIG. IV

different parts raised havoc in meeting schedules. In a certain schedule, for example, designed for completion in a single month, it was found that, while all right on the average, there was work laid out for one particular type of equipment to keep it busy forty working days out of the possible twenty-five. In other words, the carrying out of the schedule was a physical impossibility. This situation was entirely cured by utilizing the actual times of performing the operations in making up the manufacturing schedule.

CASE NO. 2.—In another shop, the machines scheduled to be made during the first half of the month left the "eye benders" with very little work, then required twice the capacity of this equipment for the balance of the month. There was only one possible result, namely, delay in getting out the work on time, plus the natural resentment of the eye bender operators who were obliged to lose time the first part of the month and then were driven during the last half in a vain attempt to accomplish the impossible. Employes consider this pretty rotten management, and it is "rotten management."

CASE NO. 3.—In a shoe shop (as in fact is generally customary) the orders were put into production as so many pairs per day, regardless of the time required on the different styles. It was found that one style required for the operation of "fancy stitching" thirty-five times as long as a certain other style (intermediate styles varying all the way between these extremes). The results were a feast and famine situation. At one time, for example, there were forty fancy stitchers. They had only enough work to keep twenty of them busy one week, while the next week, with the same number of pairs of shoes scheduled, there was enough work for sixty fancy stitchers. No wonder the operators think the management does not know its business!

COÖRDINATING NUMBER OF OPERATIVES WITH PRODUCTION

The means of correcting such situations as this, which are all too common, is through the use of time standards in planning schedules.

In the tables which follow are illustrated the manner in practical operation of adjusting, on the one hand, the schedules to the number of operatives available and, on the other hand, determining in advance the number of operatives required.

The two schedules show the number of operatives required for each operation in a garment factory for different combinations of orders.

The first column gives the different styles of coats and aprons and the second column the quantity scheduled in hundreds.

The third column gives the number of operatives per day required for the operation of seaming one hundred coats. For example, for one hundred No. 1 coats one-tenth of an operative is needed, while the total number of operatives for the scheduled quantity of eighteen hundred is 1.82, or two operatives. The other columns are carried out similarly for the other operations.

By adding the items, the total number of operators required to carry out the schedule is found.

These tables are expressed graphically in the accompanying charts. In Schedule No. 1, for example, Fig. III indicates by black lines representing the number of operatives, that in seaming, twelve operators were required, while in Schedule No. 2, Fig. IV shows that thirteen were required. Similar differences are noted in other operations. The apron and towel operators are given with the others, because the same operators make aprons and towels, as well as coats.

Comparing the two schedules, it is evident that with a constant number of employes there is necessarily a great deal of lost time. In this particular shop, before adjustment, the working time averaged 20 to 25 per cent below normal. By adjusting the schedules,

PLANNING SHEET FOR ESTABLISHING PROPER NUMBER OF EMPLOYES, BY CLASSES, FOR WEEKLY PRODUCTION SCHEDULES

Schedule No. 1

Operators per 100 = Number of operators required to turn out 100 garments in a 44-hour week.

Schedule No. 1

PLANNING SHEET FOR ESTABLISHING PROPER NUMBER OF EMPLOYES, BY CLASSES, FOR WEEKLY PRODUCTION SCHEDULES

Operators per 100 = Number of operators required to turn out 100 garments in a 44-hour week.
Quantity scheduled = Number of garments (in hundreds) scheduled for the week.
Total operators = Quantity scheduled multiplied by "operators per 100."

Style of Garment	Quantity Scheduled in 100's	OPERATIONS											
		Seaming		Facing		Sleeve Making		Finishing		Buttonholing		Towels and Aprons	
		Oper. Per 100 Coats	Total Oper.	Oper. Per 100 Coats	Total Oper.	Oper. Per 100 Coats	Total Oper.	Oper. Per 100 Coats	Total Oper.	Oper. Per 100 Coats	Total Oper.	Oper. Per 100 Coats	Total Oper.
Coats													
No. 1	4.32	0.101	0.44	0.292	1.26	0.264	1.14	0.225	0.97	0.056	0.24		
No. 3		0.109		0.196		0.264		0.226		0.051			
No. 4		0.111		0.193		0.264		0.226		0.051			
No. 6	6.64	0.123	1.06	0.236	2.04	0.264	2.20	0.226	1.95	0.063	0.55		
No. 8	4.32	0.113	0.49	0.244	1.05	0.264	1.14	0.226	0.98	0.037	0.16		
No. 9	43.20	0.119	5.14	0.237	9.82	0.264	11.40	0.226	9.75	0.051	2.21		
No. 11	43.20	0.111	4.80	0.193	8.35	0.264	11.40	0.226	9.75	0.051	2.21		
No. 12		0.150		0.376									
	103.68												
Aprons													
No. 1	10.80											0.058	0.63
No. 3												0.057	
No. 5												0.078	
No. 6	24.00											0.072	1.73
No. 6L	14.40											0.072	1.04
No. 11	24.00											0.078	1.87
Bungalow	6.00											0.458	2.75
	79.20												
Towels	120.00											0.010	1.20
Total operators required			11.93		22.52		27.36		23.40		5.37		9.22

Schedule No. 2

PLANNING SHEET FOR ESTABLISHING PROPER NUMBER OF EMPLOYES, BY CLASSES, FOR WEEKLY PRODUCTION SCHEDULES

Operators per 100 = Number of operators required to turn out 100 garments in a 44-hour week.
Quantity scheduled = Number of garments (in hundreds) scheduled for the week.
Total operators = Quantity scheduled multiplied by "operators per 100."

Style of Garment	Quantity Scheduled in 100's	OPERATIONS											
		Seaming		Facing		Sleeve Making		Finishing		Buttonholing		Towels and Aprons	
		Oper. Per 100 Coats	Total Oper.	Oper. Per 100 Coats	Total Oper.	Oper. Per 100 Coats	Total Oper.	Oper. Per 100 Coats	Total Oper.	Oper. Per 100 Coats	Total Oper.	Oper. Per 100 Coats	Total Oper.
Coats													
No. 1	18.00	0.101	1.82	0.223	5.25	0.264	4.75	0.226	4.05	0.056	1.01		
No. 2		0.109		0.196		0.264		0.226		0.051			
No. 4		0.111		0.196		0.264		0.226		0.051			
No. 6		0.123		0.236		0.264		0.226		0.063			
No. 8	27.00	0.113	3.05	0.344	6.59	0.264	7.13	0.226	6.10	0.037	1.00		
No. 9	27.00	0.119	3.22	0.237	6.40	0.264	7.13	0.226	6.10	0.051	1.38		
No. 11		0.111		0.193		0.264		0.226		0.061			
No. 12	30.00	0.150	4.50	0.376	11.28								
	102.00												
Aprons													
No. 1												0.058	
No. 3	12.00											0.057	0.68
No. 5	18.00											0.078	1.41
No. 6	20.00											0.072	1.44
No. 6L												0.072	
No. 11												0.078	
Bungalow	36.00											0.458	16.50
	86.00												
Towels	90.00											0.010	0.90
Total operators required			12.59		29.52		19.01		16.25		3.39		20.93

however, it was found that this lost time could be practically eliminated.

In practice, then, it is possible, on the one hand, from the standard times to quickly figure in advance how long is required for each item of a schedule (and this can be done by the unit time method, whether the styles are new or old), and thus either adjust the schedule to fit the operatives, or, if this is impossible (as it frequently is in shoe shops, because of hand-to-mouth buying), to figure in advance the number of operatives required for each daily or weekly schedule, so that the foreman will know in advance what provision will be necessary.

SCHEDULING REDUCES COST

The effect of such scheduling as this is remarkable in the reduction of cost in a department. If work is on a piecework basis, the employer frequently fails to recognize the fact that loss of operating time is costing him anything. As a matter of fact, since it is the weekly envelope that counts, rather than the price per piece, higher incentives are necessary with poor scheduling, in order that the workers may earn fair wages. Frequently, in fact, through proper scheduling, workers may receive appreciably larger earnings even with lower piece rates. Another factor of saving is in keeping to a minimum the number of indirect day workers. It was found in practice, for example, that the introduction of scheduling of this kind in the stitching room of a shoe shop reduced costs 10 per cent, with the same piece rates and without affecting the earnings of the operatives. In one case, this reduction in cost was effected by eliminating peaks of production which had been formerly taken care of by keeping an excess of day workers.

Furthermore, by such coördination of schedule, there follows naturally an elimination of waste time and a freer flow of work through the shop so as to shorten time in process and to permit the production and delivery of goods on schedule time.

APPROXIMATE TIMES INSUFFICIENT FOR USE IN PLANNING

Frequently the remark is made that this scheduling by times is all very nice, but that approximate or estimated times are sufficient for this purpose, especially when they are figured backwards from the ordinary piece rates, and even though these have the common large inaccuracies. Experience shows that this is not the case, that in order to properly balance the work it is just as necessary to work out time standards accurately as it is to secure well balanced incentives. Practically all piece rates, for example, based on past records or comparisons, contain many items which are inaccurate by more than 50 per cent. These inaccuracies throw out the entire program of the schedule.

QUALITY

Quality is improved by time standardization, and work carried on under incentives will produce better quality than ordinary day work, provided the incentives take into account the quality factor by giving special credit to the workers for satisfactory quality. In certain industries such as the continuous processes of pulp and paper mills, incentives may be based entirely on quality and maintenance of standards, with no time element entering in directly.

IMPORTANCE OF TIME STUDY IN FIXING SALES PRICES

Time study enables the accounting department to translate the normal cost per hour into a standard and accurate unit cost of product, thus

enabling the sales department to sell the product on a fairly stable and unchanging manufacturing cost. With this accurate basis, the sales department also can feel fairly well assured that these manufacturing costs are to be adhered to by the manufacturing department. Time standards insure uniform labor costs and are the means of accurately comparing different types of product. The importance of this factor is being recognized by only a comparatively few business organizations. Even at the present time, selling departments are often unable to use cost figures supplied by the costing department on account of the radical fluctuation in actual costs, due to increased or decreased actual expense and increased or decreased plant activity.

RULES FOR TIME STUDY [6]

Earlier in the paper the fundamental essential principles of time study are presented. It remains, however, having also outlined the practical uses as a tool of management, to enumerate briefly certain important details of the process of time study, the use of the stop watch, the taking of the observations, and the development of the standard times.

Organization.—Time study is a function distinct from plant operation. In a small plant one man only may report to the manager; in a large plant a "Methods Department" should be established to handle time study, rate setting, development of production control, and cost control.

Personnel.—A time study man must be competent to develop time standards and utilize these in rate setting, production control and cost computations. He must be a man of infinite patience, keen judgment, tact, and experience in business. He must have a good head for figures and be able to analyze conditions and methods of operating, suggest changes in equipment, work up the data and constructively utilize it.

Implements.—A watch is required—not like a football timer which operates entirely from the stem, but constructed so that the stem pressure simply throws the hand back to zero, while a slide on the side of the case starts and stops the hand. The dial, preferably, is divided into 10ths and 100ths of minutes.[7] This decimal system is convenient in working out results to avoid converting seconds to minutes.

Printed time sheets 8½ in. by 11 in. in size should be used. These sheets are mounted on a thin board having a projection at the upper right-hand corner to hold the watch, which should be in plain view.

Making Ready for the Study.—The period at which time study should be made is governed by the character of the work. This may fall into several distinct categories:

1. Operations such as machining, where the standardization of speeds and feeds and tools may be begun in advance of time study.
2. Operations wherein quality or nonuniformity of material from preceding processes or intermittent supplies require a delay in time analysis, until the preceding operations or departments, or the control of production, are brought into line.
3. Operations of hand, and sometimes of machine work, where the method of performing the operations can be studied coincidently

[6] See "Times and Job Analysis," by William O. Lichtner, Ronald Press, New York. Not only is time study practice covered in full detail, but numerous illustrations are given, showing the results of time study and the way to train the time study operative.

[7] The decimal dial was designed originally by the writer and first used in 1894.

with the timing, and the time or motion study data used with the recorded notes in determining the best methods of operation or process.

4. Operations such as stitching or other simple repetitive work which is of standard elementary nature and can be time studied whenever desired.

In addition to these might be mentioned operations involving process where time is not a direct element but where standards of quality and of process must be fixed by research, with little or no utilization of time study. Still another condition occurs when in starting up a new plant it may be necessary, in order to keep down labor cost, to set temporary standards by approximate studies. In such cases, if incentives are set, the operators must be informed by written notice that they are temporary and will only continue for a definite period. All this, however, is makeshift and should be avoided. It is better to concentrate on fixing accurate incentives promptly.

Selecting Workmen for Observation.—In the fixing of standards of performance, the workmen observed must be adapted to a degree representative of the average of the best group of workers available in the particular locality. These average workers must receive a fair reward, which, if gauged by measured output, must produce earnings appreciably in excess of a day wage. Exceptional workers must earn exceptional returns. Inferior workers must be trained to their job, and if they cannot attain earnings higher than the ordinary day wage, must be transferred to other jobs for which they are adapted.

Although the standards are designed for the average man, operatives for most extensive timing should be peculiarly adapted to their work. These are steadier workers (a necessity for good results) and will coöperate best and are apt to use the best methods of work. It is important, of course, that standards should be fixed from or based upon the observation of a sufficient number of operatives to obtain fair average results.

Approach to the Operator.—The coöperation of the worker observed must be gained before starting time study by interesting him in the work, getting his opinion and advice on methods and making him understand that the prime object is to give him regular work and higher total earnings.

Making a Time Study

1. Begin a period of time study with the hand of the watch at zero, but after this allow it to run continuously without throwing back between operations or operation elements. By this plan the delays may be recorded more accurately, smaller elements may be noted and a complete chronological record of the job may be made.
2. Record stops and delays. The time of each element is recorded in a vertical column and the individuals times afterwards computed in another vertical column at the right. The time of every delay and stoppage must also be recorded with the cause.
3. Timing the units. The elements of the operation must be small enough to utilize them in computing the times for new operations containing all or some of the same units. Note, for example, hand folding in shoe making, given earlier in the paper.
4. Be sure that the worker is not working too fast for the required quality of product. Bear in mind, however, that fast workers usually are skillful workers. Have

the output produced while timing inspected by a foreman or inspector to see that it is satisfactory.

5. Number of observations to take. This must be governed by the conditions of the work. If the operation occurs infrequently in practice, less attention is needed than for one (like the operation of hand folding described) in which the units are to be used constantly and in a multitude of combinations. Where there is a necessary appreciable variation in the time of the same unit more observations are needed than otherwise to properly distribute the irregular times.

   Theoretically the number of observations should be such that an equal number taken independently will not appreciably alter the average time.

   In general, a large number of observations should be made on, say, two or three operators particularly fitted for their work and a smaller number on others.

6. The number of operatives to observe. The number must be sufficient to obtain a fair average of the group. Careful studies on a few (say, eight or ten out of fifty) carefully selected as representative are better than haphazard studies of the entire force.

7. Fatigue. This is an element which in most cases takes care of itself, provided long time observations are made extending consecutively over several hours. In certain cases separate studies of fatigue are needed.

8. No so-called "Job Try Outs" are needed with the proper time study, although for psychological purposes it is best to introduce changes slowly.

Necessary Delays.—As already stated, delays, as well as effective time, always must be recorded. Sometimes, however, the delay is part of a unit, in which case the excess time over the average must be included as delay time. For example, in stitching, a thread may break in the middle of a seam. After taking out the actual re-threading, the time up to the break, plus the time to complete the seam after the stoppage for re-threading, will be longer than where a break has not occurred. Here, then, the extra time is considered to be the difference between the normal time and the observed time including the stoppage. This may be charged into the delay caused by the broken thread.

At times the observer notes as he makes the time study that the time required for an element is inexcusably long; it is then marked "slow," and the difference between it and the average normal time is thrown into the delay time.

Delays are of four kinds:

1. Necessary delays—delays in the actual operation that are unavoidable.
2. Unnecessary delays—such delays as loafing, stopping to talk, and performing extra operations not required (sometimes with the belief of the operator that he is "padding" the time).
3. Job time—the time required at the end of a job to record the job, move the work from the operator, get the next work and get ready to go to work on it, but not including the placing of the material ready to operate upon.
4. Personal needs. Having computed the average times and utilized the long time observations in which the operator is apt to stick to his work sixty seconds to the

minute and sixty minutes to the hour, there must be a period allowed for relaxation or "personal needs." For this there is no definite rule, but usually an allowance of 10 per cent is fair to add finally.

Continuous Timing.—Wherever practicable, before computing the standard times, a continuous study should be made covering several hours (from three to eight), allowing the watch to run continually during the entire period and making complete records of effective times and delays. Sometimes such long time observations can be used with advantage in making all of the time studies.

Computing Standard Times.—Taking account of corrections noted above, net unit times can be averaged directly to obtain the standard net unit time. Various other methods are used by different observers, but in practice this simpler plan of direct averages works to good advantage when used along with careful study and analysis of the conditions involved.

Summing up—the standard time of any operation is obtained by taking the sum of the net effective unit times plus actual times of necessary delays, plus the time required to change from one job to the next with 10 per cent on top of this for personal delay and rest. All the time used, except the 10 per cent personal, are the necessary elements (including necessary delays) covering that which the operator actually took under observation.

ACCURACY OF TIME STUDY

On work well standardized as to methods and employing skilled workers, the accuracy with which standard times can be fixed is astonishing. If set by the ordinary methods of past performance and judgment, variations in the earning power of the same operator on different kinds of work usually range from 25 to 60 per cent. On the other hand, when set by unit time or motion studies, as outlined in this paper, this variation is found to be actually reduced in practice to well under 5 per cent.

In other words, time study is really scientific and a fairly exact art. Of course, different individual workers on the same job do, and should produce widely different outputs. Furthermore, on jobs formerly on slovenly day work, standards set will naturally be improved upon with increased experience of the workers, but this should not be sufficient to be unreasonable, so far as technique is concerned. However, time study men vary in their methods. Test after test, however, has shown that really skilled time study men, working by these different methods, will nevertheless attain similar standard times.

MEASURED PRODUCTION AN ESSENTIAL TO PROGRESS

To achieve advancement it is necessary to have a gauge of comparison. The scientist must have records of what has been done in the past. The business man must know what has been and what can be done. A man is measured by his accomplishments. A factory worker must be able to show his capacity, his skill, and his initiative by some method of comparing his accomplishments with others and with his own past performance.

As a matter of fact, a measure of accomplishment is essential in any line or phase of business. On the other hand, the lack of satisfactory measures is responsible for a vast number of business failures and for much of the friction between labor and employers.

This is a bold statement, but note the continuous unrest in the needle industries, due to unsystematic busi-

ness methods and particularly to ill-adjusted wage payment. Note the attempts in the shoe industry to bargain for what should be a matter of fact record. Note the constant friction in the coal mine. But note especially, those of you who employ labor of any kind, the frequent undercurrent of dissatisfaction, often kept continuously below the surface, from inequalities of earnings due to insufficient measurement of production or to inaccurate production control.

All of these facts emphasize the importance of the proper use of Time Study as a tool to correct and develop certain fundamental phases of Business Management.

Agricultural Standardization on the Pacific Coast

By Paul E. Holden
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THE ultimate measure of any movement of the extent, proportions, and ramifications of simplification and standardization is essentially the cumulative accomplishments of individual plants, entire industries, and various geographical divisions of the country. Each in its respective field may apply the principles of standardization in a manner peculiarly and particularly adapted to its own needs.

Volumes have been written and virtually unlimited examples yet remain to be chronicled with regard to standardization achievements of individual industrial enterprises. Economies and savings to the extent of hundreds of millions of dollars have been realized. A recapitulation of the monetary results of these efforts, of course, never will be made, but it is safe to assume that the aggregate savings, if possible of tabulation, would stagger the imagination.

Coöperative simplification and standardization, which is now in the seventh year of its sponsorship by the Department of Commerce, has likewise been given wide publicity and has had country-wide acceptance. It is doubtful if there are many industrial groups in the country which have not, at least, given some consideration to the possibilities of simplifying either their products, practices, grades, or some other aspect of their operation. Without doubt the total number of industries to some extent engaged in this coöperative standardization plan would number upwards of five hundred and of individual plants involved—thousands. Even the most conservative estimates of the potential savings from this phase of the general program probably would have to be written in ten figures.

Just as individual plants and groups of plants within a given industry find in simplified practice a means of eliminating waste and improving operating conditions, so have certain sections of the country recognized the benefits and economies certain to accrue from standardization. Nowhere has the sectional plan been so fully developed and widely applied as along the Pacific Coast—easily considered as an integral section of the country, being defined geographically, topographically, climatically and economically. While Western manufacturers singly and through their trade associations have carried out individual programs or have accepted national simplified practice schedules, the most significant contribution of the Pacific Coast to the standardization movement has unquestionably been in the agricultural field. The significance lies not alone in the results achieved but in the technique developed, in the many types of application, in the difficulties inherent in standardizing the products of nature, in the enlightened coöperation from the State Agricultural Department, and in the almost universal acceptance of the philosophy of standardization by the fruit, nut, vegetable, dairy, and grain groups.

Achievements in Coöperative Organization

In considering the technique, not the least of the Pacific Coast's contributions is the remarkable achievements in coöperative organization. This method of operation has reached its highest development in the West,

and particularly in California. The success which has attended their efforts is due largely to the fact that they have been organized and managed by business men on an intensely business-like basis. In face, a recording of the progress of agricultural standardization may be said to parallel the advance and development of the coöperative organizations in the Pacific Coast States.

Good management invariably sets out to determine the circumstances with which it is or will be confronted and then establishes a technique for meeting these conditions. Obviously any standardization of agricultural products must have for its primary objectives the protection of the ultimate consumer, the appeal to the purchasers' pocketbook, regard for the interest of the growers and packers, and finally the need of economy in administration. Certain of these objectives seemingly are directly opposed or at best indicate difficulties in adjustment; for example, the interest of the grower is in being able to market at the highest price all of his output, whereas the consumer protection demands that he be insured of a very high quality if that is what he is paying for. To market advantageously the entire crop means either the broadest classification of product or a multiplicity of grades. The first alternative on the face of it would promptly vitiate the whole effort of consumer protection; the second plan not alone is the antithesis of simplification, but introduces endless complications in the determination and administration of the standards. To compromise these difficulties, the coöperative organizations have, through agricultural, marketing, and technical research, established well-defined standards; have reasonably and practicably expanded the range of standards; have developed markets for that portion of the crop which does not fall within the higher standards; and have perfected mechanical and organization machinery for administering various phases of the standardization requirements.

The standards have not been set up arbitrarily by any group, but have been the result of experience over a period of years as to the wishes and demands of the trade as well as the performance of nature. Quite frequently growers, packers, distributors, divisions of the State Agricultural Department, and railroads coöperate in the development of certain phases of the standardization programs.

DIMENSIONAL AND QUALITY STANDARDIZATIONS

Contrary to most standardization efforts, this movement has to do largely with the quality rather than the dimensional or size aspect. It is doubtful, though, if any other industrial or sectional undertaking has applied the principles of standardization in so many ways. Dimensional standardization generally reduces the wide range of sizes or shapes of a commodity line to a workable schedule and may, in addition, provide some stipulations as to finishes or performance; in other words, introduce the quality aspect to a certain extent. Beyond that, however, this type of standardization rarely goes. With agricultural standardization, as practiced in the Pacific Coast States, standards are being developed and established to cover all of the factors bearing upon quality and in addition to control those operations or processes which influence the quality, ranging all the way from picking to packing in refrigerator cars.

THE PICKING OPERATION

Considering the picking operation, for example, it has been determined

that the fruit is very materially affected by the manner in which it is removed from the tree. Depending, of course, upon the maturity of the fruit, a picker, through careless handling, will bruise the product so as to render it unsalable when it reaches the market some days later. Particularly is this true with certain deciduous fruits such as peaches, pears, cherries, and persimmons. A picker can easily spoil fruit to an amount exceeding his wages. Then, too, an untrained worker can seriously injure or ruin the trees themselves through improper picking. Thus, certain coöperative organizations have established standard practices for picking operations, which specify the manner in which the fruit should be taken from the tree and also the kind of clippers or other devices to be used.

DETERMINATION OF GRADES

Of all the phases of agricultural standardization, that most widely applied is the determination of grades. "It is impossible to exaggerate the importance of grading agricultural products as grades are to marketing what dollars are to finance—standards of value. Just as the financial character of the goods can be measured in dollars so the physical character can be measured in grades."

Prunes

Many factors go to make up the various grades of agricultural products, and these factors naturally differ with each product. Prunes, for example, are graded on the basis of size, color, skin condition (whether broken or checked), solidity of meat, degree of fermentation, and percentage of moisture. The coöperative association has established four grades of prunes as measured by all of the above factors except size. There are nine size standards known as 20/30s, 30/40s, etc. (the number per pound) which apply in turn to each of the four grades, so that prunes are classified into thirty-six different standard grades. In this instance it is readily seen that standardization is not complementary to simplification, but rather is contrary to it. With most agricultural products it is possible to expand the standards indefinitely to incorporate all the variables introduced by the vagaries of nature. The limit, however, is determined by three factors: enough grades to insure a just return to the growers, but not so many as to complicate the distribution problem or to confuse the buyer. Certain it is that the program of the prune growers organization has dispelled the feeling that prunes were just prunes, and has built up an understanding between both growers and consumers that there are certain very distinct grades of prunes, the best of which should carry a premium over others. It is true, of course, that the housewife has no knowledge of or in fact no disposition to distinguish among some thirty-six different grades; but market and trade demands vary and no one community or store handles all the various grades.

Ripe Olives

The standardization of ripe olives has been in a fashion similar to prunes. There are seven sizes which are determined by the number per pound and designated by standard terminology. Sizes are no longer known as *fancy*, *extra-fancy*, and *choice*, but are specified as *medium*, *large*, *extra large*, *mammoth*, *giant*, *jumbo*, and *colossal*. Whether or not the latter designations are any more intelligible to the consumer is a bit questionable, but at any rate the psychology is good, as there is not a *small* size, the classification starting

with *medium*. In addition to size, ripe olives are graded on the basis of maturity at picking, color, and texture.

Avocado Pear

One of the newer fruits is the avocado pear, and in determining upon standards there was not the years of experience, recorded performance, or knowledge of consumer preference which obtained among other products. Moreover, the avocado is still a luxury among food products. Consequently the standards are stringent as to appearance and palatableness. Grades are based on size, maturity, firmness, color, appearance, shape, texture, oil content, and shipping and keeping qualities. These many variables have quite naturally had the effect of expanding the number of grades so that there is no semblance of simplification. However, trade names for the four brands sufficiently distinguish the quality so that the consumer is guided in his purchase. Similarly, for virtually all types of fruits and vegetables grades have been established which will clearly and positively classify the product.

Pacific Coast Eggs

Grade standardization, likewise, is of primary concern in agricultural products other than fruits and vegetables. Pacific Coast eggs, for example, are classed and sold on very rigid specifications. Egg standards are governed by many criteria: size, color, cleanliness, weight per dozen, size of air cell, degree of freshness, flavor, and color of yolk. Size classifications are known as *standards*, *mediums*, and *peewees*. In order to increase the marketability of a producer's eggs the coöperative association has developed a sand-blasting operation which cleans those eggs too dirty to fill the requirements of the high quality product. While this process removes the natural bloom from the shell, and also weakens it slightly, still these eggs are interiorly as good as the first quality when put into immediate trade channels. Hence some consumers are getting the nutritive and qualitative value of first-grade eggs at a lower market price.

Walnuts

Four factors influence the commercial grades of walnuts: appearance, size, fullness of kernel, color of kernel. All are amenable to classification and, to a certain extent, mechanical administration. A most interesting aspect of walnut standardization has been the mechanization of the grading operation as developed by the coöperative organization representing the growers.

After the walnuts have been picked from the ground, they are husked and then cured until they contain a maximum moisture content of 8 per cent. The crop is then taken to one of the coöperative plants where the walnuts are passed over a shaker screen which removes all dirt and other foreign matter. From the screen they pass under a suction machine which is so adjusted that the blanks or partially filled nuts are lifted over a trap, while the full-kerneled nuts pass along the belt. The next stage is a hand operation; expert inspectors stand beside the conveyor and remove stained, ill-shaped, or otherwise *cull* nuts. After this the nuts are emptied into drums where they are treated with a bleaching solution from which they are taken over another shaker to remove the excess bleaching liquid. The next step is conveying the nuts to large cylindrical graders where the size selection is accomplished. From these graders the nuts pass by workers for final inspection, at which time those improperly bleached or broken in proc-

essing are removed. The foregoing process, however, merely makes the segregation on the basis of size and appearance. To grade with reference to color and fullness of kernel, a crack test is necessary. This involves the actual cracking of a specified number of nuts taken at random from a lot. The grade requirements for the No. 1 Diamond Brand stipulate at least 70 per cent light amber-colored kernels, and 90 per cent sound, edible kernels.

There is no question that one of the greatest benefits resulting from coöperative organization has been the improvement of quality in agricultural products by means of grade or quality standardization.

SHIPPING STANDARDS

As mentioned previously, standardization has had wide application among the agricultural organizations of the Pacific Coast. The coöperative organization handling "Sunkist" oranges and lemons, for instance, has not only set up standard picking and handling practices, but has developed standard field boxes and shipping boxes—one each for oranges and lemons. The standards for these shipping boxes have been established with regard to the number most advantageously packed in a refrigerator car as well as with relation to the number of oranges or lemons to be contained. Standards have been devised also for the size and kind of tissue paper used for wrapping the fruit and the quality of paper and number of colors for box labels.

Shipping boxes or *lugs* have been standardized for avocados and grapes. The prune association has established standards for the one-pound package or carton. The organization representing certain bee growers in Washington has standardized the containers in which honey is marketed, and in addition handles the bottling of the product. Only the clear, light honey is put up in glass containers. The darker product is marketed in tin pails.

The fruit canners market four grades of product and have set up standards for the quality (sugar content) of syrup and size of cans, and have determined the minimum number of pieces for each kind and grade of fruit for each of the seven sizes of cans. In similar manner the ripe olive group has prescribed the number of each of the seven sizes of olives that should be contained in each of the four sizes of cans which they have adopted as standards.

OBSTACLES AND DIFFICULTIES

The process of standardization in any field is not without obstacles and difficulties. These are accentuated in the case of agricultural products. In this field there is not only the interest of the producer and consumer to reconcile but the whims and caprices of nature must be considered. Mother nature, insofar as Pacific Coast products are concerned, works on mass production principles, but her plants are not so meticulous in the uniformity of their output as are our industrial plants. The variations between trees, between orchards, and between seasons add complications to any attempt at standardization. Beyond all of these is the determination of when to pick so that the commodity may reach its market in the most satisfactory degree of maturity. This problem is particularly acute in the case of melons. The stage at which these must be picked varies according to the distance the product is to be transported. Melons for the eastern seaboard obviously cannot reach there in the same state of desirable ripeness if picked at the same time as melons scheduled for the San Francisco market. Again, standards

must be established—this time to govern the picking period.

In commenting on the circumstances prompting standardization of avocados and the difficulties inherent in their project, the growers' organization states that the primary conditions were:

1. extremely variable nature of avocados.
2. All avocados must be picked hard from the trees.
3. The flavor and food value of avocados depend very largely upon their maturity and oil content.
4. No one but an expert has any conception of when an individual fruit is mature.
5. The only reliable method of determining maturity is a laboratory test.

In like manner all fruit and vegetable products have their peculiar features or aspects which not only make standardization a vital necessity but difficult as well.

A further consideration is that agricultural products are perishable, varying in degree as to time, temperature, and other conditions. Because of this perishability factor, transportation must be by refrigerator cars. Here proper loading practices must be established in order that products in different stages of ripeness will be placed according to the optimum temperature areas of the cars. Coöperative researches among various interested groups are being carried on in this particular connection.

STATE COÖPERATION

Agricultural interests in California have been fortunate in having the enlightened coöperation of a capable state agricultural department. In no respect has this coöperation been more beneficial than in the many standardization programs carried out by agricultural organizations. Aside from helping to develop the standards in many instances, the Department of Agriculture has, at the request of the growers and shippers, aided in framing constructive legislation to establish and make effective these standards. Since 1915, the California statute books have carried a fruit and vegetable standardization act covering certain of the principles citrus and deciduous crops in addition to berries and cantaloupes. This legislation has been prompted with no desire to exercise inimical control over agricultural business but rather to protect and promote the industry. Those engaged in producing and marketing fruits and vegetables are well aware that the future of their business depends on retaining the good will built up in the quality and grades of California products, many of which are in the luxury rather than the necessity classification. The effect of any lowering or misrepresenting of the standard grades by any grower or shipper would be reflected in impaired markets for the entire industry. Hence the desire for legislation, the purpose of which is set forth in the preamble of the California Fruit, Nut and Vegetable Standardization Act of 1927:

> An act to promote the development of the California fruit, nut, and vegetable industry in the state, interstate, and foreign markets; to protect the State's reputation in these markets, to establish standards and standard containers for certain fruits, nuts, and vegetables specified herein, and to prevent deception in the packing, marking, and sale of fruits, nuts and vegetables, to prescribe penalties for the violation of the provisions hereof. . . .

This act accurately sets forth the standards of grade, containers and markings for: oranges, lemons, grapefruit, dates, grapes, apricots, avocados, berries, cherries, peaches, pears, ori-

ental persimmons, plums and fresh prunes, pomegranates, quinces, walnuts, artichokes, cantaloupes, carrots, head lettuce, melons, onions, potatoes, sweet potatoes, and tomatoes. As the agricultural industry develops and as the experience grows, the growers and shippers request the legislature to amend these laws, always with a view to strengthening their provisions and bringing more products under their regulations. This strengthening of legislation is not as utopian as it may sound as the standardization act stipulates minimum requirements below which it is illegal to sell and already many organizations adhere to standards substantially higher than those set by law.

A further movement in the direction of state coöperation is the certification service established by act of January, 1927. This legislation provides that, upon payment of a fee, agents of the State Department of Agriculture may inspect and certify as to grade standards of any shipment of produce. This obviously facilitates negotiations between growers, shippers, or others financially interested.

RESULTS

Now what have been the results of this intensive program of agricultural standardization and supporting legislation? Certainly, a portion of the credit for the general prosperity of California agriculturists and the tremendous growth of the industry may be directly attributed to these standardization efforts. In thirty years the production of fruits alone has increased twenty times; the shipments of California fruit and vegetable products last year amounted to approximately 300,000 carloads with a value well over half a billion dollars. Despite the immensity of this output, its transportation, distribution and disposition must be accomplished with the greatest facility. To begin with, the center of the markets for these products is twenty-five hundred miles distant; then there is the perishability factor to contend with; in addition there arises the difficulty incident to handling peak loads on the transportation systems and in a few congested terminals (more than half of the Pacific Coast products goes to the New York, Boston, and Philadelphia areas); and finally the fact that the season for certain of the products is very short.

In what way, then, has standardization expedited the handling of these agricultural products, which is of such paramount importance? Grade standards, first of all, establish a basis of negotiation thus obviating lost time in bickering and quibbling over values. Second, grade standardization insures the shipment of those particular grades which are demanded in certain markets —the old example of brown eggs for Boston and white eggs for New York. Third, off-grade produce is culled at the origin so that the time and cost of handling, transporting and disposing of it is saved. Fourth, container or shipping box standardization provides a unit pack which is easy to handle, which is a desirable unit for marketing purposes, and which is designed to afford maximum loading in cars.

Aside from facilitating marketing, produce standardization aids financing in that loans can be made on graded warehouse receipts. Grade standardization has furthermore been an important factor in enabling Pacific Coast products to compete with foreign produce. In at least one instance, that of dried figs, a standardization of cultural, manufacturing, storage and merchandising methods saved an industry which three years ago faced practical destruction. A direct cost reduction, in a direction not ordinarily

witnessed, was realized as a result of standardizing egg grades. Large buyers were in a position to purchase with assurance on the producers' standards, thus obviating the necessity of re-candling, or otherwise inspecting the eggs. This lowered the handling costs to a point where merchants were able to operate on a seven to nine cent margin instead of a fourteen to fifteen cent margin.

Crate and box standardization allows the manufacturers of these containers to operate on mass production lines and hence to produce for stock during slack periods. The benefits ramify widely.

As for the ultimate consumer, whose interests are of primary concern, quite certainly he has benefited immeasurably and in many ways. If simplification and standardization have any merit or objective at all it is in reducing costs. That this objective has been realized in the case of the purchaser of agricultural produce from the Pacific States can be supported by facts and instances no end. Moreover, equally important to the consumer is the assurance that he is either getting what he pays for or has a positive basis of recourse. Benefits to the consumer are manifested in the direction of service, quality,. appearance, and other appeals and conveniences.

As a final remark, it may be safely stated that whereas standardization of the agricultural output in the Pacific Coast States has not been a panacea for all of this industry's ills, nor is it a pet nostrum of snake oil propensities, yet it has been one of the most significant aspects of this industry's development. From the various examples cited, it has been shown that virtually any phase of this agricultural operation is amenable to standardization and hence intelligent control.

Intra-Plant Standardization

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NOTHING quite so completely epitomizes the philosophy of present-day production as the one word, *specialization*, which in turn connotes standardization. The efforts, progress and results of the broad co-operative movement of simplification and standardization, guided and sponsored by the Department of Commerce, have been widely disseminated and generally endorsed. That this national program for the elimination of production waste is probably the most outstanding industrial achievement, from a dollars and cents standpoint, in the last decade, is largely recognized.

Manifestly this coördinated plan, which is based on the coöperation of all or a large proportion of an industry, has its limitations—it cannot, for very obvious reasons, encompass the vast field of application open to the individual manufacturer. So despite the tremendous savings accomplished in this nation-wide effort, many individual plants have not as yet made the most of the possibilities afforded by intelligent intra-plant standardization. In the first place, conditions within a given plant are so individual in many respects that a coöperative standardization would be utterly impossible. Secondly, the more intimate details of operation and management are matters over which the individual plant must have full control and in which the highest individual ingenuity must be allowed to operate.

It is evident, therefore, that the individual manufacturer has an infinitely greater opportunity to secure the many benefits and economies of standardization than is possible solely through the coöperative movement within an entire industry. In fact, the possibilities run virtually the entire gamut of factory operation. A few of these possibilities together with the manner in which certain manufacturing concerns have handled them are set forth in the following paragraphs:

Materials

Most plants make some attempt at a standardization of the raw materials and supplies which they fabricate and use, but relatively few have actually developed a set of material standards with sufficient thought and study to realize the full benefits of such an effort. Too often the entire question of materials and supplies is left solely to the purchasing agent, who, likely as not, has but a limited technical background and, therefore, only a very general appreciation of the manifold factors involved in the selection of the best materials or supplies for a specific purpose. On the contrary, it is not uncommon to find the idea of specialization of materials carried too far, with the result that inventories are much higher than need be or would be, if a thorough study were made to adjust conditions so that one size and specification would serve amply the purposes of several uses of relatively the same requirements. That an effort to simplify materials and supplies will bring results is indicated by the experience of two of the country's largest railroads. The Pennsylvania Railroad eliminated 44 per cent of the items carried in stores, making a reduction of from 140,000 to 78,000 items; the Union Pacific Railroad made a 46 per cent

reduction in the number of items carried in stock and promptly released $18,000,000 tied up in stores inventories.

One large manufacturer of machinery had an extensive survey of his material requirements conducted by a committee composed of representatives of the production, engineering and purchasing departments. Included in their analysis were steels, non-ferrous metals, textile fabrics, leather, wood products, lubricants, fuels, and chemicals. As a result, not only were the varieties of steels reduced from 73 to 38, as an example of simplification, but, for each item, standard specifications were drawn covering composition, physical properties, dimensional standards, dimensional tolerances, cutting lengths and variations, finish, weight tolerances, supply instructions, inspection provisions and tests. Moreover, good commercial specifications were adopted wherever possible, rather than stipulating highly special requirements.

With concentration on fewer varieties of materials, the purchasing department is obviously in a better position to keep in touch with market conditions and also to place larger, though fewer, orders thereby receiving the benefit of lower prices and larger discounts. Furthermore, there is not the likelihood of a sudden depletion of a certain raw material or supply with the resultant temporary shut-down until stock can be replenished—a situation which is more serious where specifications are unusual or peculiar to the particular company. Material standardization likewise removes certain manufacturing hazards. The production department, when assured of a standardization in the quality of the raw materials to be processed, is protected against the receipt of off-standard stock likely to lengthen machining times, cause heavy tool breakage and increase production costs. Heat treating operations are facilitated and losses due to improper temperatures are reduced to a minimum by constant qualities of raw materials. Bonus or piece rates are not subject to criticism by the workers when the machineability of the materials reaching their operation is constant rather than alternatingly good and bad.

Thus it is patent that a standardization of materials and supplies results in benefits ramifying throughout the entire plant.

EQUIPMENT

Plant equipment includes everything with which the employees are to work: machinery, tools, dies, jigs, fixtures, benches, chairs, belts, trucks, toteboxes, etc. All are amenable to standardization.

It is not difficult to assay the advantages of machinery standardization and yet countless plants are equipped with a collection of machinery which would do credit to an industrial museum. Unquestionably, for every production operation, there is some size and type of machine which is better adapted to the purpose than any other. To determine which machine would best do the work is, of course, not accomplished through grab-bag procedure, but neither is it by high-powered salesmanship. Intelligent study of the field, with perhaps a reasonable amount of experimentation, should, in the vast majority of cases, indicate the proper machine, and where a number of machines are to be put in operation on the same, or similar work, a standardization on this one type is of inestimable value.

To begin with, the purchase of a number of units from one manufacturer would doubtless carry with it a sizable discount. Then the question of repairs is greatly simplified and service facili-

tated. Through complete interchangeability, emergency repairs can be made by taking a part from a machine which may be temporarily idle. Then, too, it is often necessary to shift operators from one machine to another due to various causes, but the usual resultant slowing down is obviated with standardized equipment because of the workers' familiarity with the particular type of machine. This same familiarity speeds up the work of the set-up men who are skilled and therefore highly paid workers. Moreover, machinery standardization is applicable whether for special and single purpose machines or general purpose machines.

Going a step further, tools and fixtures likewise can be thoroughly standardized with dollars and cents results. Most of the same economies will accrue as with machinery standardization—interchangeability, better service, familiarity of operators and set-up men. Tool-room operation is correspondingly simplified as regards the issuance, storage, maintenance, design and making of tools and fixtures.

In like manner, and with comparable results, benches, chairs, desks, trucks, tote-boxes, and all the other shop equipment can be profitably standardized.

The benefits from equipment standardization extend beyond the factory divisions. The purchasing department, for instance, can place orders for standardized machinery and tools with much less clerical and other effort. The diversity of selection open to purchasing agents may be indicated when we note, for example, that the manufacturers of grinding wheels, although accomplishing a 64 per cent simplification, still offer 255,800 varieties. What is true of grinding wheels is also more or less true of many other tool and equipment lines, so that equipment standardization is a very worth-while effort from a purchasing standpoint alone.

PROCESSES

Using the phrase, popularized by the late Frank B. Gilbreth, there is a "one best way" of performing every productive operation and a one best sequence of these operations as constituting a manufacturing process. Such a statement sounds trite, but relatively few plants have any assurance that the same parts from day to day are being processed in an identical way and in a way, moreover, which has been proven the best.

In a steel mill, the process of making certain laboratory analyses on a heat of steel is standardized and the consequences of any hit-or-miss methods are well known and no detailing of them is necessary here. Yet, losses daily result and go unheeded in plants due to a lack of uniformity in manufacturing processes equally vital. Such losses take the form not only of production inefficiencies, but reflect themselves in the quality of the final product. A company can have no greater asset than high quality consistently maintained.

The advantages of process standardization take on added significance when a concern operates a number of plants throughout the country producing the same line of products. Here headquarter's supervision of quality and productiveness is remote and assurances of high standards of both can be accomplished only through complete uniformity of processes. Such a case is represented by a company manufacturing heavy machinery in some forty or more plants well scattered geographically. This concern, through a committee of plant engineers, has developed and put into practice standard processes for enamelling, die casting, heat treating, rust proofing, painting, varnishing, pickling, kiln drying,

etc. As a consequence a similar unit produced by any one of the plants is identical in every respect and the productive efficiency of the various branches is maintained. The principle of process standardization has been extended by this company to its various design departments and a complete set of designs practices has been developed. As typical of these may be cited—factors of safety, running fits, tolerances, bearing pressures, bushing proportions, lubrication, dust proofing, methods of rating, methods of guaging, spring design formulas, working stresses, taper fits, etc.

CONDITIONS

Probably no phase of standardization is more productive of results than that which provides for identical circumstances under which a workman performs the same operation. It was Frederick W. Taylor who first pointed out the importance of this principle of scientific management. To quote:

> Each man's task should call for a full day's work, and at the same time the workman should be given such standard conditions and appliances as will enable him to accomplish his task with certainty.

Standardizing conditions involves certain of the previously mentioned applications, such as materials, machinery, tools, fixtures and methods, and, in addition, such factors as light, heat, ventilation, speeds and feeds of equipment. Obviously, no operator can daily turn out the same quantity and quality of work if, for instance, the materials which come to him are variable as to machineability, dimensions or finish. Neither can he consistently deliver full production if the belts on his machine are not properly tightened or if the tools, dies, jigs, or fixtures are not sharp and adequately maintained. Moreover, it is not likely that day to day output will be the same if there has been no definite standardization of processes—the sequence of operations being left entirely to the ingenuity and memory of the workman.

Similarly, no operator, regardless of his loyalty and desire to render a full day's work, can produce the same quantity and quality of work if on dark cloudy days he is working under half the illumination intensity he experiences on clear days; or if the temperature at his place of work is 65° one day and 45° the next; or if on one operation the smoke or dust is completely removed and on others no exhaust or ventilation provisions are made; or if on soft materials the machines are geared to feed and operate at the same speed as for harder materials.

All of these conditions have a positive influence on the productiveness of a plant and its workers; all are controllable, and all amenable to standardization.

COMPONENT PARTS

The principle of component parts standardization has perhaps been more generally applied than any other phase of the whole range of standardization possibilities. It is difficult to conceive of any plant manufacturing an assembled product not being in a position to bring about some standardization of the parts which go to make up the final product. Trade conditions may make it necessary to have a diversified line, but such a situation does not preclude the possibility of a standardization of component parts and sub-assemblies. In fact, an analysis of the several thousand parts going to make up the various models of automobiles produced by any one of our large manufacturers would reveal an astonishing degree of standardization and interchangeability. According to the General Motors Corporation, approximately 70 per cent of an automobile is composed of so-called minor parts.

In their plants the number of these were reduced from 13,000 to 2,100 with a resultant decrease in the manufacturing cost and a greatly simplified service problem.

What is true of the automotive industry likewise obtains in other lines. A manufacturer of kitchen cabinets produces nine models and sizes, but 75 per cent of the component parts making up these nine models are standard and interchangeable. Farm implements apparently afford ample opportunity for parts standardization in view of the accomplishments in this direction achieved by two of the largest producers. For example, Deere & Company found that for every newly developed machine a special seat was being designed until a sizable array of dies and other tools for making these seats was tieing up considerable investment. Now every piece of machinery, whether a plow or a corn planter, is equipped with a standardized seat. Levers, latches, single trees, chains, brackets, springs and similar machine elements are likewise standardized.

To overcome this same and natural inclination of designers, a concern producing optical instruments set up in their drafting department, a board on which were mounted samples of the more common and less significant parts going into their products. In the development of any new model, the designer is instructed to concentrate his attention on the more important parts and for such items as thumb screws, hand wheels, ratchets, and the like, to make his selection of one of the samples displayed. Samples, moreover, for which materials and complete sets of tools and fixtures are already on hand.

FINISHED PRODUCT

The results possible from standardization of the completed product have been so thoroughly broadcast that a discussion here would be reiteration. However, many manufacturers are in industries which do not lend themselves particularly to coöperative simplification and therefore must apply the principles individually. The various style lines might well be cited as an example, and many plants in this field have found it profitable to follow a reasonable standardization of their products. A manufacturer of men's hats was able to eliminate 60 per cent of his 3684 varieties and at the same time virtually do away with the pronounced seasonal operation of his plant. Moreover, he was able to do a $4,000,000 annual business on a $176,000 inventory in contrast with a previous $1,600,000 business on a $500,000 inventory, thus increasing his capital turnover from 3.2 to 22.7 times per year. With similar results a manufacturer of men's clothing standardized 24 styles of blue serge suits out of his previous line of 1000 styles, thereby reducing overhead costs 50 per cent, increasing sales from 30,000 to 60,000 suits annually, and extending the annual production period of his plant from thirty-six to fifty-two weeks. In shoes, underwear, and even ladies' hats, definite progress has been made by certain companies.

Thus to the individual manufacturer, regardless of the nature of his industry and the articles he makes, is open the opportunity to establish standards for sizes, colors, finishes, grades, and brands of his finished product.

CRATES AND CARTONS

The opportunities to effect savings in this aspect of the standardization program has escaped the attention of many plants. To be sure the results will not likely be as spectacular as those due to other efforts, yet some very real economies can be achieved.

Most plants have given consideration to the sizes of crates and cartons which most satisfactorily house their products. Due regard to lumber conservation has been considered also, and dimensioned lumber or box shooks are purchased by many concerns.

It is the exceptional plant, however, which has studied the science of packing to any appreciable extent—determining the thickness and spacing of slats in a crate to give the necessary strength with a minimum of lumber; studying the correct placing of braces to render maximum resistance to breakage; ascertaining the proper size and spacing of nails to securely fasten the crate together with as few nails—and the necessary labor to drive them—as possible. A technical discussion of the field of standardization in the packing and shipping room is not possible here, but suffice it to say that exhaustive researches have been carried out by the Forest Products Laboratory located at Madison, Wisconsin, from which data is obtainable.

TERMINOLOGY

Of all the avoidable wastes occurring in the normal manufacturing establishment, none is more insidious nor more stupendous than that due to misunderstandings or lengthy directions resulting from a lack of standardization of everyday plant terminology. The same department, operation, machine, tool, or part, usually goes by several different names or designations. Even when there is some uniformity of nomenclature, redundancy is usually the case, and time incalculable is unnecessarily consumed in giving directions, preparing shop orders, and keeping plant records under such conditions.

No industrial waste on the other hand is subject to treatment with less effort or expense. Much of the lost time can be entirely eliminated by nothing more than a well developed system of symbolization and classification. Departments, processes, materials, machinery, tools, supplies, operations—all can be readily identified, easily remembered, quickly designated, and promptly recorded by a simple scheme of symbols. Several well known and successfully applied systems are available in book form, but in lieu of a readymade system, a series of symbols can be adequately devised by any plant to serve its specific purposes and suit its own requirements.

The foregoing phases of intra-plant standardization are but typical of what manufacturing concerns are doing and will be merely suggestive to the production executive wherein the technique of standardization may be applied. Furthermore, what is true for shop practice is equally applicable to office operation.

Office supplies, typewriters and similar machines, desks, tables, chairs, file cabinets and the forms and records which they house, clerical operations, routines, functions, conditions and terminology are all subject to standardization. Moreover, these afford opportunities for savings and economies comparable to those effected in the production divisions of a manufacturing enterprise.

As a closing statement I think it is safe to say that while the philosophy of standardization has had wide acceptance among business executives, the virtually unlimited opportunities for applying its principles have not and are not being fully realized in most of our industrial and commercial institutions.

Standardization at Cronk and Carrier Mfg. Co., Canton, Ohio

By F. A. Schmidt
Swineford Division of the Cronk and Carrier Mfg. Co.

It was desired to include in this volume an illustration of standardization throughout a medium-sized plant. This article concerning the standardization work of the Swineford Division of the Cronk and Carrier Mfg. Co. fills this need. The Cronk and Carrier Mfg. Co. is composed of three divisions: Montour Falls, Potter Department and Swineford Division at Canton, Ohio, formerly the G. A. Swineford Company. This article relates to the standardization work at the latter plant. The product of this company includes steel goods, pliers, pruning shears, garden sets, snow shovels, tools, hedge shears, trowels and haying tools.—Editor.

Standardization means fixing the nature of an object, the procedure of an action or the status of a relation. Its application is continuous and progressive in the same degree as times and human conceptions and conduct change. But that which has been standardized is considered fixed for the time being for the practical purpose of dealing with it as a definite value. A thing in process of change cannot lead to a definite conception, and consequently cannot be entered into a calculation for desired facts.

In the first instance, therefore, management aims to operate with *definite* values, and only in the second instance does it strive for the *highest* and *best* values obtainable. Thus, all management is essentially a process of standardization in the sense that it first establishes all items, and then, by being able to evaluate them in relation to the general action, it raises and enhances them to suit a projected improved process.

There are certain basic standards of scientific fact, such as numerals and units of measurement, which may be regarded as *final standards* and which apply universally. In our discussion of *standardization* at the Cronk & Carrier Mfg. Co. no claim is made for any development of this scope, and our conception of *standardization* is fixed at the narrower limit of the individual problems of our particular industry.

We propose to distinguish between (A) standardization of material, (B) of operations and (C) of tools, although the development is interrelated and is depending on a succession of simultaneous steps in all three departments.

A. Standardization of Material

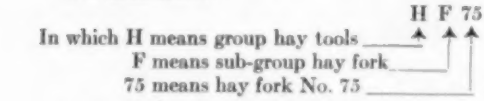
In standardizing material we fix its name, its weight and measure, its cost and its quantity.

The first step is a classification assigning to each article a symbol which definitely establishes and describes it and eliminating the old confusion of many different names. Further, by asserting the relationship of all items, our *classification* accomplishes the work of correlating them once for all which otherwise has to be repeated incessantly. Our material classification is divided into four groups: product, product stores, general stores and worked material.

The product classification is a list of the finished product, identifying main groups by a first symbol, a sub-group

by a second symbol, and the specific article by a number.

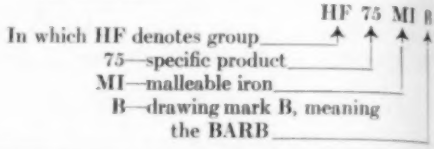
To illustrate:



For complete list see illustration No. 1.

The product stores classification concerns raw material on which *no* work has been done in the plant, and which is kept in stock specifically for one only product.

To illustrate:



CRONK & CARRIER PRODUCTS AT CANTON

D—DIGGING TOOLS
DD—*Digging Bars*
DD—700
DD—710
DP—*Post Diggers*
DP—603
DP—604
DP—605
DP—606

H—HAY TOOLS
HC—*Cars and Track*
HC—4
HC—5
HC—20
HC—25
HC—30
HC—40
HC—45
HC—55
HC—60
HC—65
HC—70

HF—*Hay Forks*
HF—75
HF—80
HF—81
HF—85

HS—*Hay Slings*
HS—95
HS—96
HS—97
HS—98
HS—99

HK—*Hay Knives*
HK—300
HK—305
HK—310
HK—315

HP—*Hay Fork Pullies*
HP—104
HP—105
HP—111
HP—112
HP—113
HP—133
HP—135
HP—145
HP—150
HP—151
HP—155
HP—156
HP—157
HP—165
HP—166
HP—167
HP—168
HP—170
HP—171
HP—175
HP—178
HP—179
HP—180
HP—185
HP—190

L—SHOVELS, CLEANERS
LA—*Sidewalk Cleaners*
LA—375
LA—380
LA—500
LA—505
LA—507
LA—508
LA—551
LA—552
LA—550

LS—*Shovels, Scoops*
LS—350
LS—355
LS—360
LS—1360
LS—365
LS—1365
LS—385
LS—1385
LS—390
LS—1390
LS—395
LS—1395

R—RAKES
RD—*Wood Lawn Rakes*
RD—205—22
RD—205—26
RD—205—38
RD—210
RD—211

RR—*Wire Lawn Rakes*
RR—213
RR—214
RR—215
RR—216
RR—220
RR—234

NR—*Mop Wringers*
NR—900

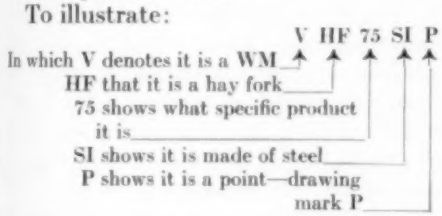
PRODUCT CLASSIFICATION—ILLUSTRATION NO. 1

The product store is identified by a letter added to the product symbol (identical with a drawing mark), and is prefixed by CI when it is cast iron, MI when malleable iron, SI when it is steel, and is not thus prefixed when consisting of material other than either cast iron, malleable iron or steel. The product store classification is used to identify the patterns as well as dies, jiggs and tools, and constitutes, therefore, a standard for our records.

The general store classification concerns raw material in stock on which no work has been done in the plant, and which may be used for several, or all the product. It is material mostly purchased in the open market as *standard* makes, such as bolts, rivets, bars, nails and so forth. General stores are prefixed by the letter S.

The worked material classification includes all material stored, on which work *has* been done in the plant, and which is kept in readiness for assembly into one or more products belonging to one only product group. It is identified by the letter V in front of the symbol which is otherwise the same as for the product store.

To illustrate:



From the foregoing, it is evident that a product may be composed of product stores, general stores or worked material, depending on the nature of the article as well as on the *standardized* process of manufacture, which decides what parts shall be carried as stores and which as worked material. This is a most important junction of standardization of material and standardization of operation, to which we shall refer later.

The above grouping of material into products, product stores, general stores and worked material facilitates the standardization of weights and measures, as the specifications for each class are fundamentally different. Thus, for *product*, the item of finish and appearance is particularized, for the *stores* the weights and dimensions are essential, while for *worked material* the workmanship and degree of precision for interchangeability are the keynotes. In standardizing the weights and measures of the stores and worked material, we largely effect the standardization of the finished product itself.

The *unit* in which material is to be considered is made standard, that is, it is decided whether it is to be carried as pounds, pieces, feet, board feet, tons, barrels, bales, dozens, gallons, gross or hundred weights.

On basis of this unit standardization the weights are fixed. Other specifications, down to chemical analysis, differ widely as to their minuteness in accordance with the practical requirements of control, rather than abstract scientific fact.

Examples: Steel sheets for shovel making are standardized as to dimensions: 48 x 120 and 40 x 120 x .0625 gauge, tolerance 3/1000th over or under .30 carbon. They are bought in App. 20 ton carload lots, which are the basis for job lots, in which the entire carload is often scheduled to move on to finished material, from a standard unloading to standard finishing operation.

Castings for RR214 lawn brackets (RR214MIC), weight .45 pounds sandblasted and not tumbled, with standard handle socket core and standard head cores at right (90 degree) angles to one another.

Bars for HF75 hay fork points (VHF75SIP) are standard in $\frac{7}{8}$" x

$\frac{1}{4}''$ x $16'\upsilon''$ sizes, .20 carbon, suitable for welding. Size permits cutting without waste. Ordered in mill quantity, special analysis, minimum one ton.

The standardization of *material cost* is relative to market conditions and special purchase contracts, in so far as the stores are concerned. Standard manufacturing cost on worked material and finished product is an average of past performance, and is established on our cost cards. They constitute a guide line for comparisons and form the basis for fixing the selling prices and the general business policy. These cost standards are computed through our general accounting and cost keeping system, and, of course, are the result of the standards of all details. They are the most vital single issue of what we conceive as: *standards*.

The standardization of the material quantity is effected by determining the minimum quantity to which the inventory is allowed to decrease on basis of a sales analysis, and by fixing the ordering quantity in which material is to be purchased or manufactured on basis of the most economic production lots. These standards are carried on the balance sheets.

B. Standardization of Operations

The standardization of operations deals with the establishment of the manufacturing process in its entirety, with the process of fabrication of each product, and, finally, with each operation required to do the job.

As we are producing a variety of products of which different groups are made in different seasons, a certain cycle on basis of the calendar has been evolved with the view of distributing the working load as uniformly as possible over the year. Thus, lawn rakes are made in October, November and December, hay tools in December, January, February and March. In April and May an interseason prevails during which worked materials for all products are made for stock. June, July, August, September and October are the months in which the shovels, scoops and other winter goods are made.

The process of fabrication for each product is standardized in our product analysis sheets or route sheets. (See illustration No. 2.)

Here a primary bill of material distinguishes between stores and worked materials for each product. For each worked material in turn, a secondary bill of material distinguishes between stores and worked materials, and so on, until each worked material is reduced to its stores.

Now under each worked material so evolved we list the operations required to convert its stores. It goes without saying that there are stores on which work will be performed, and which in succeeding assembly operations will be incorporated directly into the finished product without ever being stocked as worked material. It is at this point where the standardization of process and standardization of material are simultaneous. The consideration of process economy decides whether a material should be stocked after some work has been done upon it, or whether it should be left in process until finally assembled. It is also at this point where the development of production methods and detail operations have to advance before the standardization of each process can be accomplished.

The standardization of each operation required to do the job is essentially based on time study, and is established on detailed instruction cards. (See illustration No. 3.)

These standards are summed up in a single figure denoting number of pieces per hour, and are the basis for a bonus

PRODUCT HF 75

STORES	WORKED MATERIAL
2—HF 75 MIL	1—VHF 75 SIA
2—HF 75 MIB	2—VHF 75 SIP
2—HF 75 CIH	2—VHF 75 SIC
	2—VHF 75 SID
8—SR 5/16 x 1 5/16	
8—SR 5/16 x 5/8	
2—SR 5/16 x 1 5/8	

VHF 75 SIA		VHF 75 SIC	
1—HF 75 MIR	0	2—SA 3/16 x 7/8 x 17 1/2	0
1—SR 3/16 x 1 1/8			
1—SA 5/8 x 7/8 x 24″			
VHF 75 SIP		**VHF 75 SID**	
4—SA 1/4 x 7/8 x 30″	0	2—SA 3/16 x 7/8 x 22″	0

OPERATIONS

VHF 75 SIA		VHF 75 SIC	
1. Cut	MS 1—300	1. Cut	MS 1—400
2. Insert ring	MN 2—100	2. Punch	MS 1—220
3. Bend	MB —100	3. Shear round	MS 1—350
4. Drill	MD 1— 30	4. Ctsk	MD 1—310
5. Swedge	MP 2—400		
VHF 75 SIP		**VHF 75 SID**	
1. Cut	MS 1—140	1. Cut	MS 1—400
2. Punch	MS 1—140	2. Punch	MS 1—220
3. Ctsk	MD 1—220	3. Shear round	MS 1—350
4. Weld	MH 3— 90	4. Bend	MD 1—310
5. Grind	MG 1—375	**HF 75 MIB**	
6. Shear round	MS 1—350	1. Ream	MD 2—350
		HF 75 MIL	
		1. Ream	MD 2—350

HF 75

1. Assemble	MN 2— 14
2. Dip	MB 7—150
3. Bundle	MY 9—100

PRODUCT ANALYSIS—ILLUSTRATION NO. 2

plan of wage payment. The figures are recorded as far as they have been developed on the product analysis sheets opposite the operations (see illustration No. 2), unless elementary coefficients are used for varying operating conditions which cannot be recorded in a single figure.

The development of these operating standards is taking place continuously. In the beginning it was a more or less cursory recording of what took place, uncovering many conditions which were responsible for great variations in output. Where the standards were improved, this was without exception due to a change in the division of work, and not even temporary standardiza-

INSTRUCTION CARD	OPERATIONS	STORES OR WM
	1. Unload	VLS 360 SIA
Date	2. First shear MSS	VLS 390 SIA
Sept. 9th, 1927	3. Second shear MSS	VLS 395 SIA

	Time Allowed
1. UNLOAD—one man	
Once per carload	
1. Place runway from building to car	3.00 Min.
2. Unbolt dunnage on both ends	4.00
3. Pick up first sheet and drop on runway	.50
4. Place two platforms at right angles to shear	3.00
Once per Sheet. Repeat for n sheets in shipment	
1. Pick up sheet, drag from car, pivot and drop at right angle to shear blade	.54
2. FIRST SHEAR. Two shear men and one catcher	
Once per Operation	
1. Set shear gage to 19½". Check it. Oil	4.00 Min.
Once per Sheet. Repeat for n sheets	
1. Pick up sheet	.13
Once per Sheet Trip. Repeat 6 times for n sheets	
1. Move sheet to gage and trip shear	.05
Once per Shift. Repeat n tons divided by 1.5	
1. Replace loaded platform with empty	5.00
3. SECOND SHEAR. One shear man and one catcher	
Once per Operation	
1. Set gage to 10" or 12". Check it. Oil	4.00 Min.
Once per Shift—as above	
1. Move FIRST sheared steel into position	10.00
Once per Second Sheet. Repeat n *first* sheets times 6	
1. Pick up sheet	.07
Once per Shear Trip. Repeat n *second* sheets times ⅓	
1. Move sheet up to gage and trip shear	.05

General Instruction.—Oil the machine before starting. In setting the gages check front and back gages for perfect alignment, place square and sheet edge on straight edge for checking squareness of blanks. Do not proceed unless gages are right. In picking up sheets and moving them up to the gage take care to be opposite the catcher, bear either to the left or right, so that material will move in a straight path to its pile on the platform.

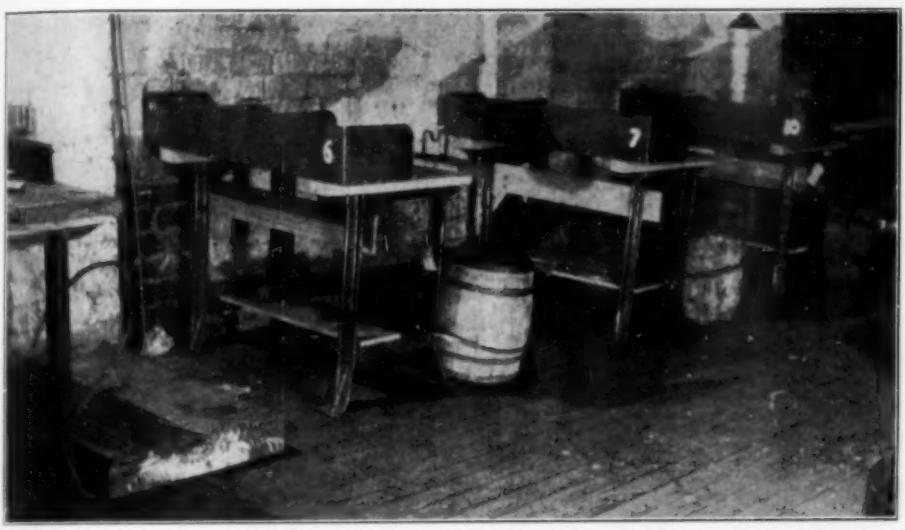
INSTRUCTION CARD—ILLUSTRATION NO. 3

tion of process could be thought of until the operations were studied and a more equitable division of work and responsibility was effected.

In many instances the study of operations led to the construction of better tools and improved set-ups, sometimes the study brought about a new design of the product itself, and sometimes special machines had to be devised to obtain satisfactory solutions for effecting standards of efficiency as well as standards of quality.

The study of operations with the view of establishing standards for them was guided by the fundamental thought of the dynamic, straightway production method. Accordingly, work was *so* divided and rearranged that the greatest possible number of

successive operations were of equal duration and could be coupled together under *one* standard. Thus, in making shovels or scoops, all assembly operations, about 20, have been "balanced," with the result that the product is not batched until ready for shipment. The handling of bulk between operations has here been eliminated, and the stress of control greatly lightened: the "static" element of work has been minimized.



Dimensions: 29" deep x 48" wide x 35" high, built on standard bench legs, with 8" backguard and movable division boards. The top plank is drilled for standard attachments required by bench operations for various products.

STANDARD INDIVIDUAL BENCH—ILLUSTRATION NO. 4

The standardization of an operation is the sum of the standards of each work element inherent in the operation, and the standard of the work element is the result of standardized equipment and environment. Detail instructions for maintaining and controlling the operating standards are based on standard tools, jiggs, auxiliary equipment and environment, of which examples will be briefly enumerated in the following chapter.

C. STANDARDIZATION OF TOOLS

The rules for classifying tools are similar as for materials. We distinguish between machine tools, product tools and general tools and have classified them accordingly.

The machine tool classification is a list of all work places, and is identified by the letter M. MA stands for automatics, MD for drills, MH for hammers, MN for benches, MP for presses, MZ for saws, etc. They are recorded opposite each operation on the product analysis sheet. (See illustration No. 2.)

The product tool classification concerns all tools used on machine tools and work places for one class of product only. Their symbols are made up by the addition of two letters to the product store or work material symbol.

To illustrate:

VHF75SIP T P

In which VHF75SIP shows the WM

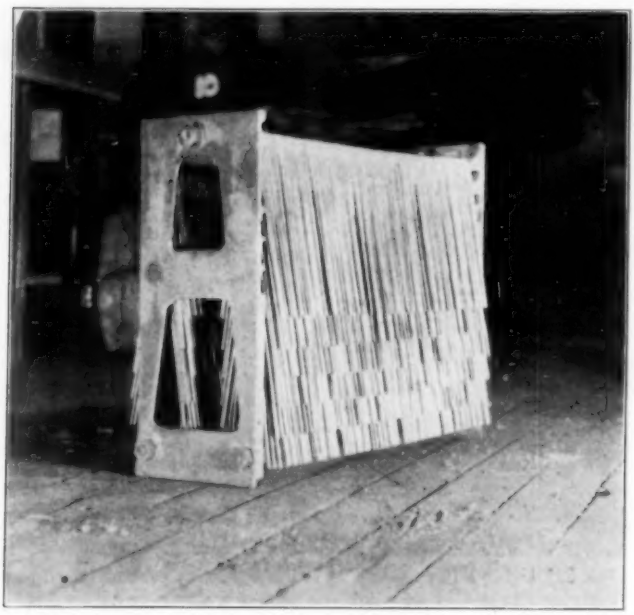
T—that it is a tool

P—that it is punch

The general tool classification concerns tools which have not been specially made for a product, but which have universal application or might be

bought in the open market, such as hammers, pliers, screw drivers or chisels. These tools are identified by the letter T and, of course, are not prefixed by a WM symbol.

Physical and mechanical developments of tools and fixtures in the course of standardization may be better understood in the light of the following concrete examples:



Dimensions, 8″ wide x 25″ long x 18″ high. Capacity, 2000 teeth; displacement, 2 cu. ft. Consists of 12 removable rods resting in cinched notches on end frames. Rake teeth are stored on these racks nested. Old method of handling these teeth loosely in barrels required 9 cu. ft. of space.

STANDARD RAKE TOOTH RACK—ILLUSTRATION NO. 5

1. *Individual benches.* The old type gang bench was a source of interference among the men, could not be equipped with auxiliary contrivances, was not suited to an orderly flow of incoming and outgoing work, and made fixing responsibility for good or bad work impossible.

A standard four-foot workbench (see illustration No. 4) with an eight-inch backguard and movable division boards on standard steel bench legs was therefore developed. The benches can be lowered or raised to suit the height of operator, have individual lights, constitute numbered work places, are definitely assignable and are so arranged that neither operators nor their work can interfere with one another. The division boards keep rivets and small parts in order. Where formerly it proved impossible to measure work and insure a standard work method for various products, these difficulties have been largely overcome, the efficiency has been increased on most bench work operations, and the standard of quality is being maintained.

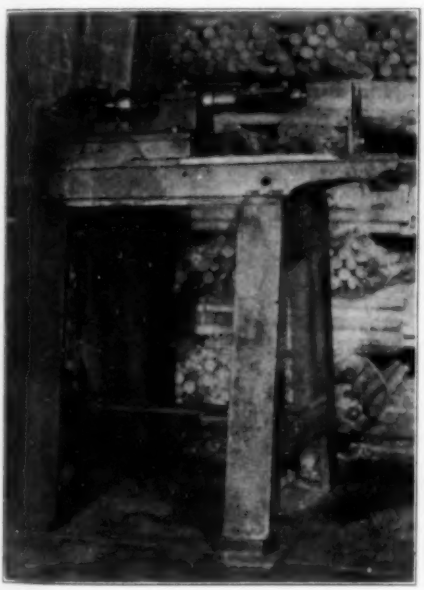
2. *Die shoes.* Where formerly die shoes of various dimensions were used we standardized on one opening and machined the throat to fit the die blocks so as to avoid the use of shims or extended set screws and to eliminate a lengthy process of fitting by trial and error.

3. *Rake tooth rack.* A standard rack to receive rake teeth prior to assembly, and suitable to our standard benches, holds 2000 teeth in a space of two cubic feet as against 1200 teeth in nine cubic feet formerly. The entire 2000 teeth are lifted on the bench and are in evenly convenient reach in positive order, whereas formerly only 250 teeth at a time were lifted out of a barrel onto a bench in a loose heap. The saving of extra moves and false moves can readily be calculated. (See illustration No. 5.)

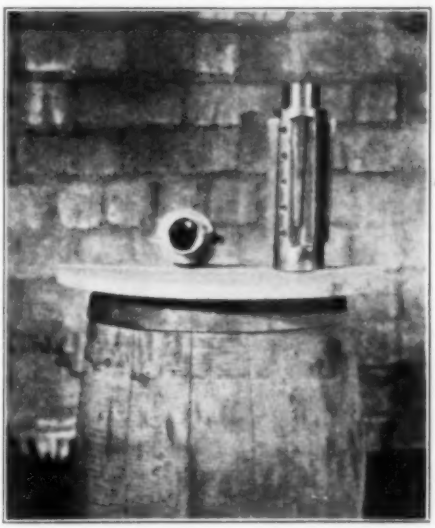
4. *Standard shovel socket.* The socket has been standardized for *all* shovels and scoops made at our plant. While this means a standardized construction of product, it was caused by the problem of tool standardization, pertaining specially to such tools as the handle chuck, blanking dies, closing dies, multiple drill and riveting equipment. Incidentally, the rivets themselves were standardized. This means not only a very considerable saving in equipment and its upkeep, but also a reduction of the expense of changing set-ups which we now often keep intact for weeks, permitting the continuous running of various shovels and scoops. Furthermore, the standardization of the socket for *all* shovels and scoops provided the economic justification for developing and installing an automatic handle chucking machine.

5. *Automatic chucking machine.* Chucking a handle means turning its lower end to the exact taper required by the shovel socket. The old method of hand chucking required two men and offered no equipment except a fast revolving spindle with a single knife cutting tool, into which the handle was pushed according to the judgment of one of the operators or both of them. The average output of these two men was below 200/hr. They suffered burned hands and sometimes more serious accidents when a handle would stick, break and fly about. (See illustration No. 6, Exhibit A.)

We developed a two-knife cutting tool balanced both statically as well as dynamically, *i.e.*, the knives are arranged so as to cut evenly on opposite sides of the handle and the frame is machined out of a solid piece of machine steel in such a way that its center of gravity is in line with its axis. Incidentally, this design was adopted as a standard for all other chucking opera-

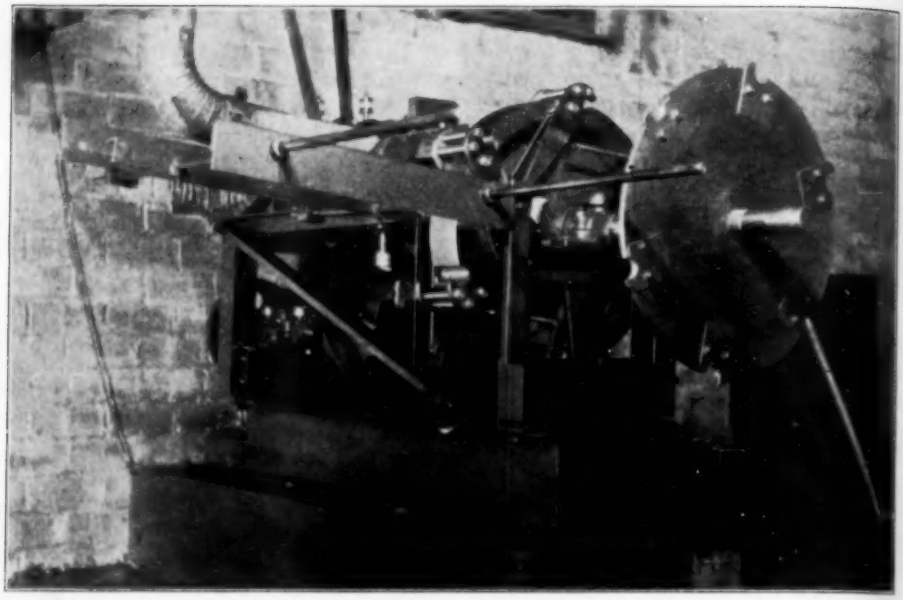


Capacity 200/hr. with 2 men. Method is unsafe and does not produce uniformity of quality.
Old Handle Chuck—Exh. A



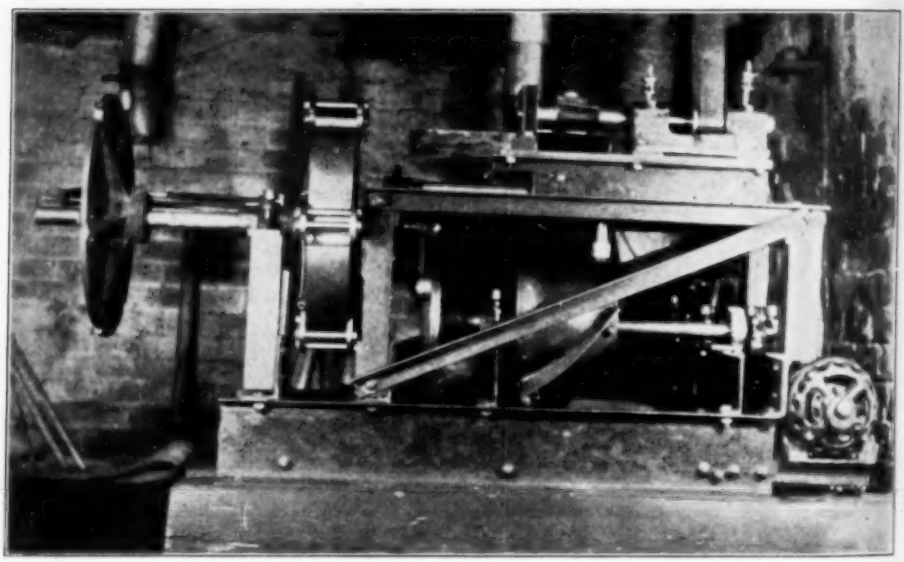
Chucking tool of 2 knives balanced statically and dynamically. Knives are held by 5 set screws and are not weakened by any holes.
Exh. B

AUTOMATIC CHUCKING MACHINE—ILLUSTRATION NO. 6



Capacity 500/hr. with one man, method is safe and provides standard quality of output. This view shows intake side and arrangement of adjustable feeder apron.

Automatic Chucking Machine—Exh. C



Showing discharge side of Exh. C. where the sanding operator takes each handle as delivered and places it into the sanding machine. Straightway working method.

AUTOMATIC CHUCKING MACHINE—ILLUSTRATION NO. 6

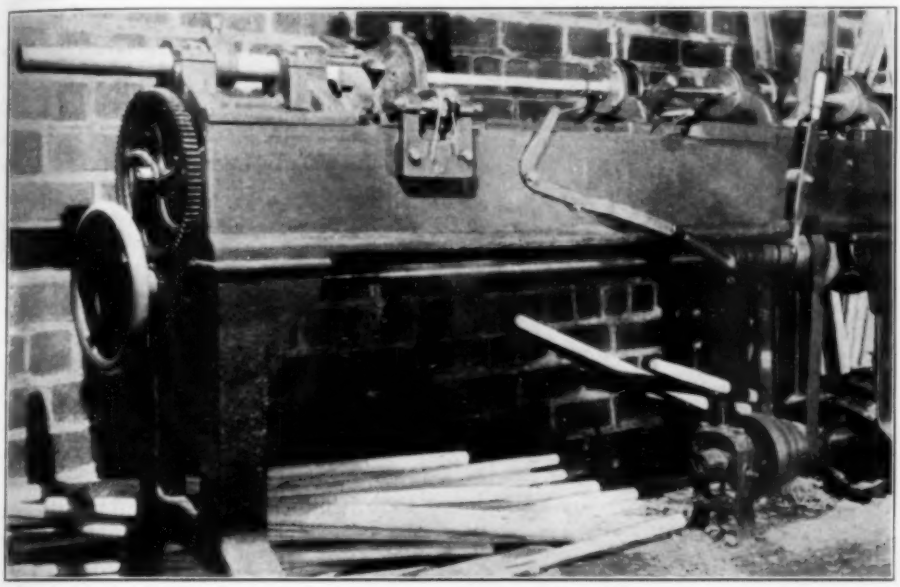
tions as it reduced vibrations, minimized interruptions and, of course, developed double the cutting capacity for the same number of revolutions. (See illustration No. 6, Exhibit B.)

This cutting tool was mounted into the automatic chucking machine. This machine is built on the dynamic, straightway principle, picks up a handle at a time in its open dial jaws, closes these jaws tightly as it moves up into position by a ratchet movement and discharges the finished handle after the cutting tool on its carriage has done its work. The standard operating time is 500/hr. for one man as against 200/hr. for two men formerly. (See illustration No. 6, Exhibit C.)

Not only did we gain an actual automatically counted, operating standard, but by the alignment of the machine we obtained a standard taper of nearly absolute symmetry and minimized the hazard of personal injury.

As the chucking operation is followed by sanding, the standard of 500 four-foot handles per hour has been made to apply to the sander also, by increasing its speed proportionately, and the handles are passed through the sander as fast as the chucking machine delivers them.

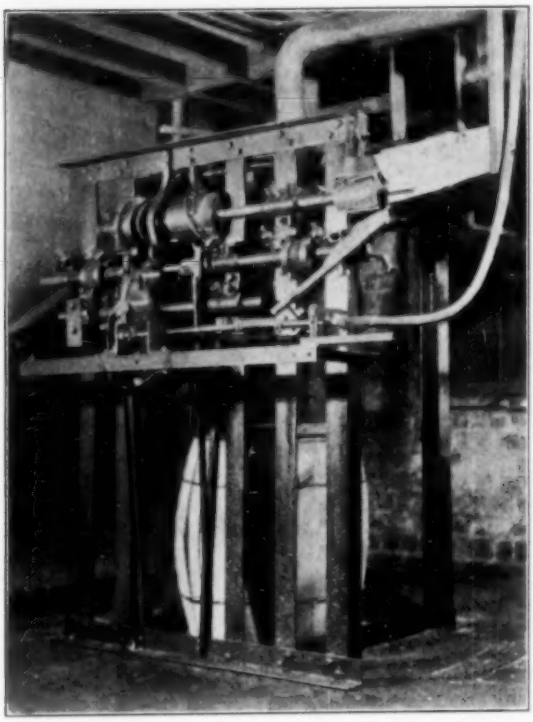
6. *Rake tooth machine.* The development of this machine involved a complete revision of the process of making wooden rake teeth and a change of the final unit. The old machine used a square stick $\frac{5}{8}''$ x $\frac{5}{8}''$ x $17\frac{1}{4}''$ out of which three teeth were formed by way of a reciprocating ratchet feed, leaving a dead end $3\frac{3}{8}''$ in length. The operator had to insert each stick and catch each finished tooth by hand. A new stick could not be inserted into the machine until the preceding three teeth, one after an-



OLD WAY.—Unit, $\frac{5}{8}''$ x $\frac{5}{8}''$ x $17\frac{1}{4}''$. Direct Waste, $3\frac{3}{8}''$ or 20%. Capacity, 300/hr. Reciprocating ratchet feed, hand served. Constant 3 point center of attention by operator. Fatigue factor about 45%. Hazard of injury to left hand.

AUTOMATIC RAKE TOOTH MACHINE—ILLUSTRATION NO. 7A

other, had been taken out and the remnant end removed. This involved not only a great fatigue element, owing to the posture, distance of movement and three-point center of attention of the operator, but also a 20 per cent waste of all material prepared for the machine.



NEW WAY.—Unit, ½″ round x 4½″. No direct waste. Capacity, 900/hr. Automatic feed from hopper through pneumatic tube. No fatigue factor, less floor space, lower power consumption, assured safety. Dynamic straightway production process.

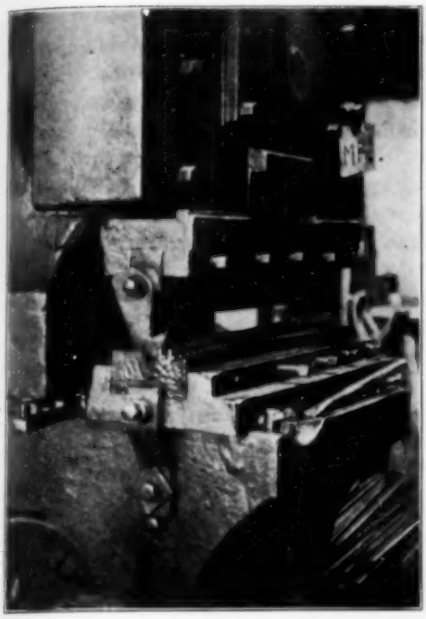
AUTOMATIC RAKE TOOTH MACHINE—ILLUSTRATION NO. 7B

The new machine process cuts ½″ round by 4½″ long dowels beforehand, which are the standard units, and feeds them automatically into a dial by means of a pneumatic tube. This dial simultaneously moves the dowel into a position where two cutting heads will close in upon it, discharges the preceding finished rake tooth, and picks up the next one. The operator is merely charging the feeding hopper and is otherwise free to watch the performance of the machine, gauge the dimensions of the product, and take care of lubrication. The capacity of this machine is 900/hr. as against an average of 300/hr. formerly; there is a 20 per cent direct saving of material, and an indirect saving owing to the smaller unit of 4½″ as compared with 17¼″ length. (See illustration No. 7.) The principle here, too, is the dynamic continuous method and the standard is measured by an automatic counter in a positive manner.

7. *Rake head rolling mill.* Our wire lawn rake heads are formed into a tube of a somewhat square shape after the flat blanks have been gang punched. This forming operation used to be done on a press over a mandrel which was placed into the U bend.

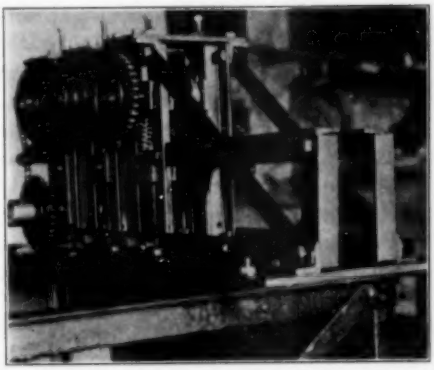
Studies revealed great variations in output owing to the mandrel sticking, and the process of inserting and taking out of the forming dies proved slow and tedious. (See illustration No. 8A.)

To overcome these troubles a small three roll mill was constructed which rolled the head in a straightway even speed. (See illustration No. 8B.) As the forming is taking care of itself, once the steel is started into the mill the operator is free to pick up the next steel and have it ready for insertion before the preceding steel is entirely completed. Thus, not only a standard performance was achieved, but also a considerable increase in efficiency. The standard of the mill is 900/hr. as against 150/hr. with the old mandrel process. Incidentally, the cross sec-



Old method of forming steel rake heads on press operation over mandrel. Capacity, 150/hr.

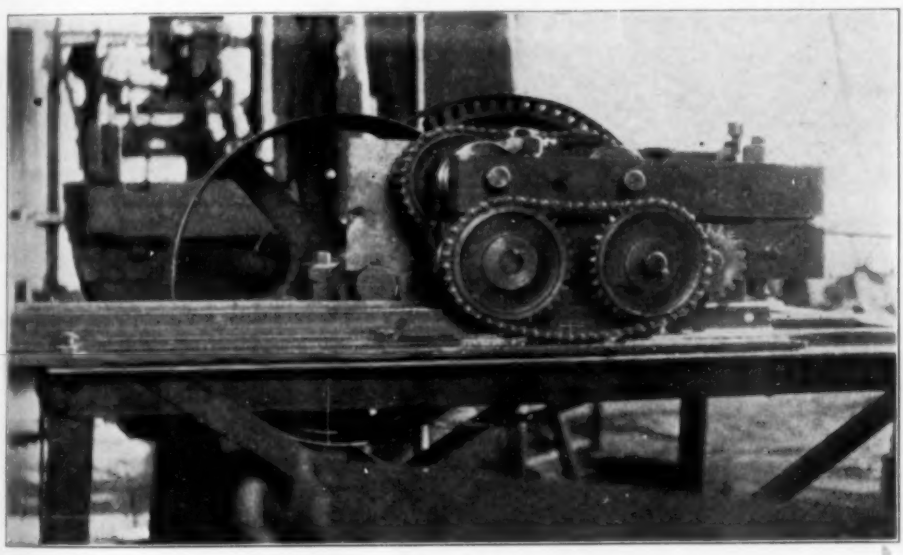
Exh. 8A



Original design of rolling mill, improved as shown in Exh. B. Principle of straightway, continuous production method.

tion of all steel rake heads has been standardized to fit the mill, the length being immaterial to a single pass rolling operation.

8. *Automatic handle painter.* Considerable trouble was experienced in obtaining a standard finish on our rake or shovel handles. The old method was provided to replace the sanding

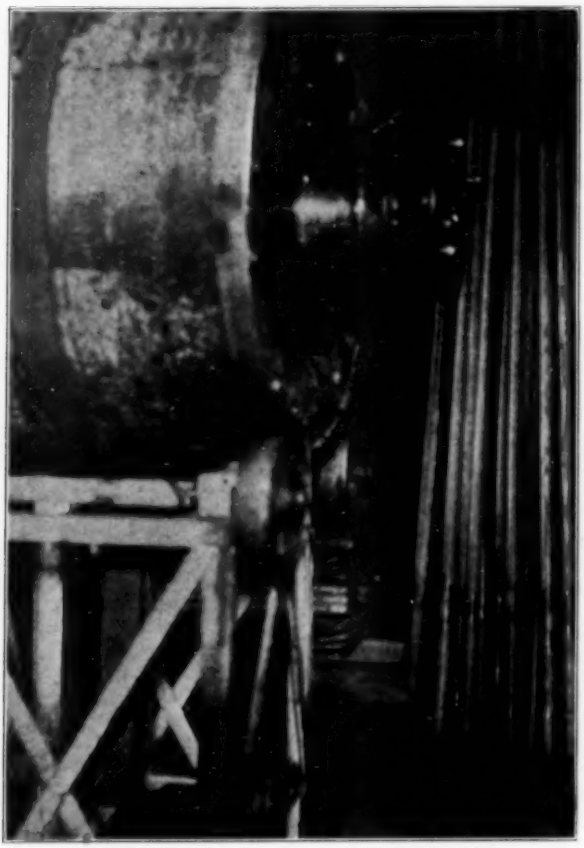


New method, multiple roll, single pass rolling mill. Capacity 900/hr.
Exh. 8B

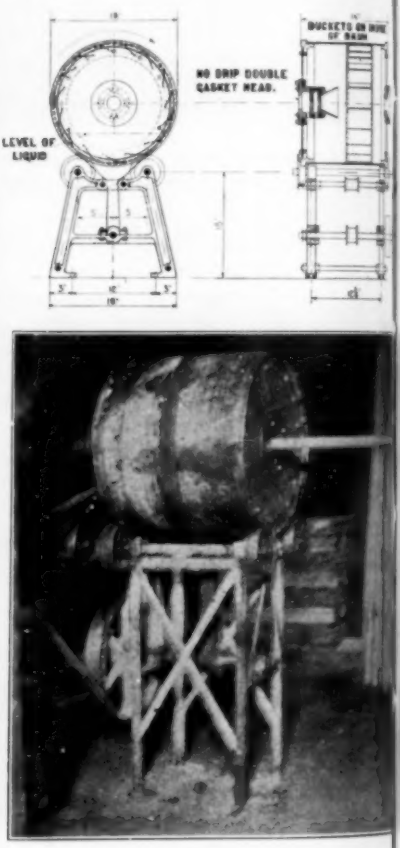
RAKE HEAD ROLLING MILL—ILLUSTRATION NO. 8

belts of the sanding machine with canvas, apply a coat of wax to the canvas and pass all handles through the machine a second time for this waxing operation. A uniform application could not be achieved with this equipment as the wax rapidly decreased on the fast spinning canvas belts, resulting in a rapidly diminishing finish until the wax was again replenished on the belts.

The automatic handle painting machine evolved to meet this contingency consists of a drum revolving on trunions and is equipped with buckets on the inside. The handles pass directly from the sander through center openings of the drum, about one-fourth filled with lacquer or clear duco. As the drum revolves, the buckets are turned upside down in the course of each revolution and empty their contents on the handles. The outport of the drum is equipped with a head holding two gaskets of pure, elastic rubber, with holes somewhat smaller than the diameter of the handles, so that they produce a reliable stripping action as the handles are pushed through. The principle is known as the "gasket dip method." Our contrivance elaborates it to a continuous, straightway



Gasket head pulled out of the drum showing arrangement of the gaskets and drip ports.



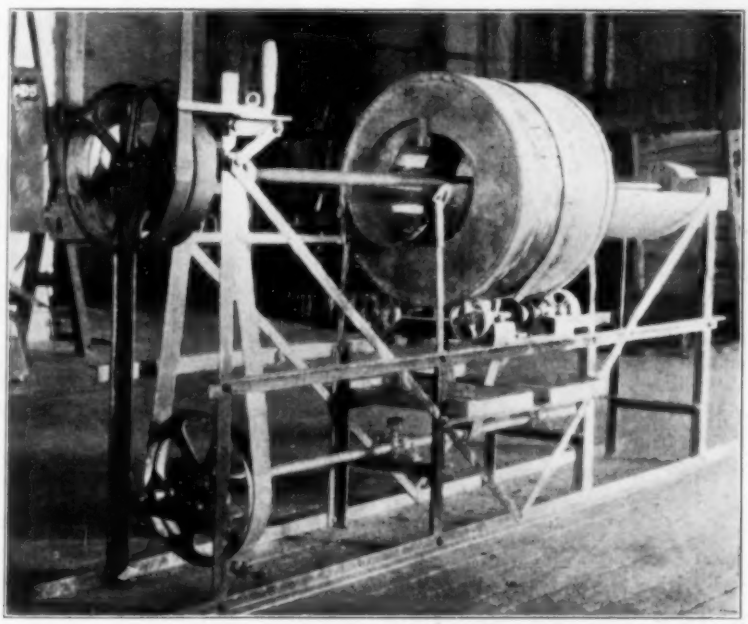
Provides continuous, straightway produ tion method and a standard finish. *Patente*

AUTOMATIC HANDLE PAINTER—ILLUSTRATION NO. 9

method and makes it automatical by coupling it directly to the sanding machine, which henceforth performs both sanding and painting in one operation. As the sander has an automatic invariable feed, the painting operation thus also becomes standardized. (See illustration No. 9.)

9. *The aluminum bronzing machine.* The old method of mixing up a thirty-gallon batch of aluminum bronze and varnish in a tank and painting the products by submerging them therein, proved highly unsatisfactory. This, because the amount of material so mixed was greatly in excess of what was actually needed to cover the product, and also because the settlement of the bronze flakes to the bottom of the tank soon caused the consistency of the mix to lose its uniformity with a corresponding change of the lustre of the finish. Mechanical stirring devices and air blown into the mix were only partially successful, and did not produce the desired result.

The solution was found in our automatic aluminum bronzing machine, consisting of a drum, revolving on trunnions and equipped with buckets on the inner wall of its mantle. The openings in each end are commensurate with the size of the articles to be painted, and a screw is leading through its vertical center. On this screw on suitable hooks the articles pass through the drum as it revolves, slow enough for a complete drenching and fast enough for a high labor efficiency. Between one to three gallons are continuously being dipped up and dropped again as the buckets turn upside down

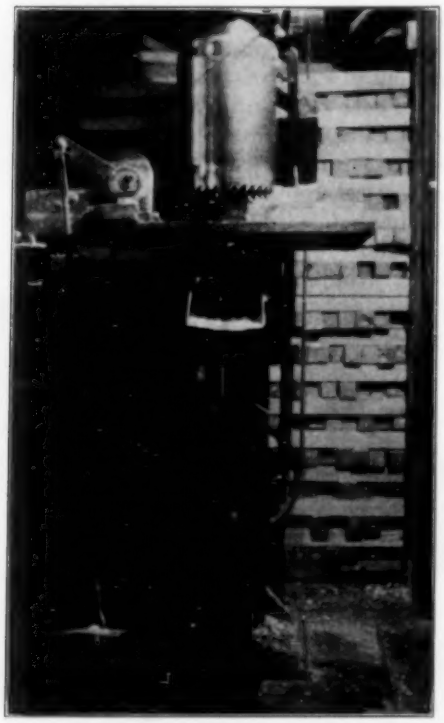


Amount of liquid revolving with drum is from one gallon minimum to 3 gallons maximum. Baffles or buckets on the inner wall of the mantle produce a continuous mixing action and at the same time a complete drenching of any articles passing through the drum. Provides straightway, continuous production method and a standard, otherwise unequalled, lustre of finish. *Patented.*

ALUMINUM BRONZING MACHINE—ILLUSTRATION NO. 10

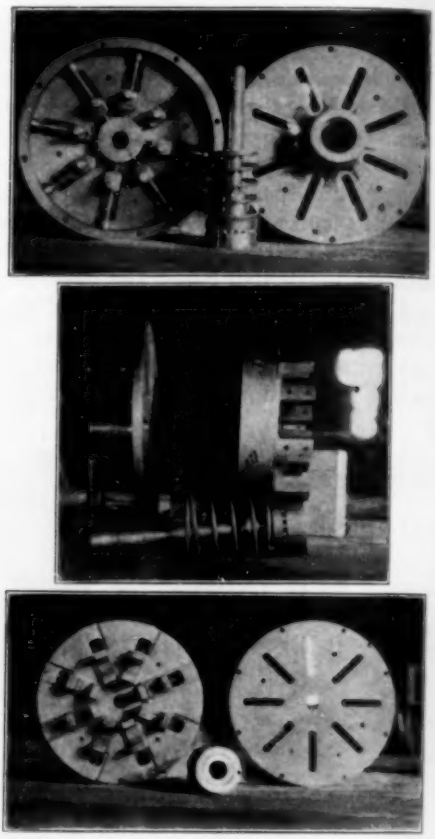
in the course of each revolution. The articles are carried through the drum on a screw as we have described, and out over a dripping pan so arranged that any drippage runs back into the drum and is again absorbed and thoroughly mixed by the main body of the bronzing fluid. (See our illustration No. 10.)

The economic significance may be readily understood when comparing one gallon in the drum with thirty gallons in the old submersion tank. Actual performance showed a consumption of only fourteen pounds of bronze as against seventy pounds for a batch of 350 dozen wire lawn rakes; but more important, a standard of efficiency and a standard of quality were achieved, and thus, our primary object realized.



Old type round saw for one diameter only. In case a tooth broke all teeth had to be ground and filed to new level.

Exh. A



Standardizing *one* tooth interchangeable for 8 radial carriages and adjustable for any diameter from 4″ to 14″. Mounted into old Press shown in Exh. A.

Exh. B

UNIVERSAL ROUND CUTTER—ILLUSTRATION NO. 11

CONCLUSION

In conclusion we wish to point out that while we have distinguished between standardization of material,

operations, and tools, and while the standards have been evolved in this general sequence, all three departments have their retroactive influence upon another, often necessitating a retracing of ground and not permitting the adherence to a strict program.

The efforts to establish standards have made us realize our limitations and imperfections, but unfailingly pointed the way to achievement and progress.

Gages as an Instrument of Control in Mass Production

By John Gaillard
Mechanical Engineer, American Engineering Standards Committee

THE necessity to defend his existence against the influences of his surroundings forced primitive man to become a provider of goods before he had grown up to master the arts of manufacture and measurement.

The first goods he used were supplied him in ready-made form by nature. Boulders and wood clubs constituted the first means of preparedness in addition to the strength of his own limbs. Man in that early stage could collect things, but he could not shape them. Tools were unknown to him.

Then, one day, he got the idea of striking chips off a piece of flint to give it a new shape, thus making it more suitable to serve as a chisel, one of his first tools. By this shape-giving process consisting in the removal of material from nature's coarse product, he entered the first stage of manufacture whose principle is analogous to "subtraction" in arithmetic. This principle remains today one of the most important in the manufacturing industries; the wood working industries, for example, still apply it to products as directly supplied by nature, while the metal working industries apply it to products having undergone first a certain transformation in the hands of man, for example, by casting, forging, or rolling.

The possibility and necessity of a further step in manufacture became evident. A pointed tool, similar to the chisel, and tied to a wooden shaft, provided a suitable arrow or spear. This manufacture required the combination, or "assembly," of several parts, in addition to the processes by which they were given a proper shape. Thus man started a higher form of manufacture corresponding to "addition" in arithmetic. Its application required, if not yet actual measurement, at least a much better judgment of the proportions of, and the correlation between the component parts of built-up products, than the manufacture of elementary parts on the "subtraction" basis ever had done. A string of suitable strength and length had to be selected to tie arrow point and shaft together, else the parts might separate even before the arrow was used.

Handicraft

We do not know in what stage of the development of man's manufacturing skill the ever keener judgment of his growing craftsmanship began to be supported by measurement as we understand it today, that is, the determination and expression of dimensions (in the widest sense of the word) in definite units. It is certain, however, that so far as the elements of a composite product were concerned, direct comparison of their essential dimensions, especially those governing proper assembly, became a question of increasing importance. The parts had to "fit" correctly together, if they were to blend into a whole answering its purpose well.

Home manufacture of the necessities of life spread out and differentiated into trades. The expert craftsman, concentrating on the problems in his own line, devised new tools and equipment specially adapted to his

work and began to lay down his experience in terms of measurement, for the purpose of planning and record. The guilds born from the glory of handicraft crystallized standards of workmanship, and the pride of their masters was to be able to create the entire product, with great perfection in all its details.

Both shape-giving and assembly of the component parts were problems of the individual craftsman. The cabinetmaker was expected to be able to produce a perfect dove-tail joint as well as to turn or carve a leg, or plane a panel, of a piece of furniture. The locksmith had to make a hinge which not only was a beautiful forging, but which also was loose enough in its joint to swing smoothly, and tight enough to keep the door or lid in the right path. The craftsman could ponder over his work and give it all the care required to comply with the high standard set for the masterpiece before it was finally delivered to the user, an eloquent achievement of the craftsman's all-round skill.

MECHANICAL PRODUCTION

The introduction of steam as a driving power put at the disposal of the manufacturing trades production machinery whose operating members were driven at a higher speed and with greater force than the human hand had been able to impart to the tools of the handicraft period. The capacity of production per unit of time was thus increased manifold while new technical possibilities were opened. Moreover, the tirelessness of the machine extended the possible actual working time far beyond the point where human beings would have been forced to quit, their energy giving out.

On the strength of these two advancements, the production of goods soared quickly, raising with it the level of average living conditions, a fact which in its turn again stimulated the demand for greater and better production. This phenomenon of mutual induction increased the demand for higher speed of production to such a degree that new methods had to be introduced in order to satisfy the demand. The speed of the shape-giving operations (which now had largely become "machining" operations) having their technical limitations (running a lathe too fast will spoil both the tool and the workpiece), an attack was made on the methods of assembly. Most products being of a composite nature and therefore requiring assembly operations, much was to be gained if an advance could be made in this direction.

ASSEMBLING OPERATIONS

Assembly methods had not participated in the progress made by shape-giving operations. The workman was still assembling "mating" parts by starting out with too large a total amount of material and removing the excess by the method of "subtraction"; an internal and an external part were made to fit together either by reducing the size of the internal part or by increasing the size of the hole in the external part. Therefore, while in the shape-giving operations the workman had received considerable help from the machine-tool to which part of his effort and skill had been transferred, his status with regard to the assembling operations had not materially changed since he was a craftsman. This fact was due to several conditions. First, the fitting together of parts in the manner then used, required a considerable amount of effort in observation, comparison, and correction of the dimensions of the parts concerned, before the right fit was obtained. The motions involved in assembly opera-

tions being more numerous and more complicated than the elementary operations such as turning, planing, drilling, and the like, which had been entrusted to the care of the machine-tool, mechanical equipment for the performance of assembly operations would have been too intricate and consequently too costly an investment. Furthermore, the young machine was, in some respects of accuracy, still at a disadvantage in comparison with the direct descendant of the old time craftsman: it could not yet work with the high precision acquired by the human race through centuries of experience and training. Man had, it is true, put the machine in charge of many operations, but he had still much to teach it.

MASS PRODUCTION

The solution was found in so-called "mass production," characterized by a greater subdivision of the production process than had obtained heretofore, and a distinct separation between shape-giving and assembling operations.

In the form as originally developed, mass production consisted in the manufacture of the component parts in separate lots and in quick succession, followed by their assembly into the final product. Such procedure still involved a certain stagnation in the progress of the components, caused by the fact that all but one of the parts of a lot accumulating in a particular production place, had to wait till the completion of the lot before being shifted to the next operation. A lot might even be temporarily stored before entering the production process again.

The waiting periods inherent in "lot production" are avoided in a more modern development of mass production, namely, "continuous flow production." The principle of this method consists in that the component materials or parts either move at once, after the completion of an operation, to the next operation place, or move continuously (on some kind of conveyor) past the various subsequent operation places. This cuts down the total production time considerably and consequently makes both for higher capacity of production (output per time unit) and for a larger return on capital invested in raw materials, because of quicker turnover.

Both lot production and continuous flow production are applied in mass production of the present, the answer to the question which of the two is the most economic, depending on the particular conditions of each individual case, such as the kind of industry, volume of production, availability of skilled labor, and other factors.

The divorce, in mass production, between shape-giving and assembling operations, resulted in greater possible concentration in both fields and a corresponding increase in efficiency. The elimination of the waste of time involved in changing over, in the old system, from machining to assembling operations and conversely, brought about part of the savings.

It thus happened that, just as long ago the demand for more and better products had chased manufacture out of the home and dispersed it, subdivided and specialized, over many trades, the same phenomenon now caused the manufacture of composite products to split up into the separate manufactures of their component parts. Here also was an opportunity for greater specialization and stronger concentration as to quantity and quality of output, than in a production process where one individual or group was the creator of the whole, although with the help of machinery.

INTERCHANGEABILITY OF PARTS

For the proper execution of the plan of separate shape-giving and assembly operations, the fulfillment of one condition became imperative, namely the interchangeability of parts of the same kind, so that any part taken at random from the lot in which it was produced, would equally well answer the requirements of a correct fit when assembled. Indeed, if in assembling the parts they had to be selected as to size, much of the gain in time and effort obtained by the new plan would be lost again, or even the new procedure might unfavorably compare in this respect with the old one involving combined shape-giving and assembly operations.

Interchangeable parts may be obtained by keeping their dimensions closely to the carefully selected dimensions laid down in the basic design of the product. This design represents ideal conditions which, however, cannot materialize in actual production. Although basic or nominal dimensions are specified, certain deviations from these, caused by imperfections in the manufacturing process, cannot be avoided. For example, the production machinery, accurate though it may be, is subject to constant wear. The tools (lathe tool, grinding wheel, milling cutter) in removing material from the parts being machined, are to a lesser degree, but constantly, decreasing in size themselves by loss of material at their cutting edges or surfaces. While the machine is adjusted, at the start of a machining operation, to produce parts of a definite size, this wear of the tool causes the size of the parts subsequently produced, to change accordingly. The diameter of shafts or pins, turned on a lathe, for example, increases as the cutting edge of the lathe tool wears down. The wear of a reamer used for finishing drilled holes in order to give them the correct size and high grade surface, causes each hole to be slightly smaller than the previous one. The difference in size between two consecutive parts is minute, the steel of the tool being highly resistive, but the effect accumulates steadily; the parts "grow" in size—on the outside or the inside, as the case may be—as the tool wears.

Fortunately, a slight deviation from the basic dimension of a part can be allowed to occur without its impairing the correct functioning of the part. How large the permissible deviation is, depends on the nature of the part and on its particular function. The permissible total variation in the size of a part is called the "tolerance" on its size. Two extreme sizes, a large one and a small one, form the boundaries of the tolerance; these are the "manufacturing limits" or briefly, "limits." Economy of production calls for the adoption, by the designer, of the largest possible tolerances compatible with good technical results, or in other words, of the widest possible limits.

The basic principle then, underlying the manufacture of interchangeable parts, is that any part whose actual size is "within the limits" is acceptable with a view to assembly conditions. The exact value of its size is of no particular importance; the fact that the deviation from ideal size is smaller than the tolerance guarantees that it will answer its purpose in a satisfactory manner.

The variation in actual size of the parts, caused by the wear of tools and other imperfections in the manufacturing process, does not constitute, therefore, a real difficulty. For example, the constant "growth" of a part through tool wear can be safely allowed to go on, provided that it be stopped, by resetting the tool to its original position, before the size tres-

passes one of the limits set for such part.

Maintenance of the size of the parts between their limits is imperative, if wasteful and costly errors are to be avoided in the assembling operations. As, moreover, occasionally certain parts of a mechanism must be kept within the limits as close together as a few tenthousandths of an inch, a continuous check must be made as to whether or not they are "true to size." The term "continuous" does not mean in this respect that such check must always be made on every individual part; the accuracy of the machine-tool, in combination with a fairly large tolerance on the parts, often renders it possible to perform a satisfactory inspection by picking, from time to time, one part from the lot in which it was produced and finding out whether its size is acceptable. If so, it may be safely assumed that all parts, produced since the previous check was made, are also acceptable. However, in cases where the parts have to fulfill an essential function in the assembled product and its tolerance is small and therefore liable to be soon exceeded, a check on every part produced may be necessary.

HIGH SPEED INSPECTION

Mechanical mass production thus gave rise to the problem of checking the size of the large number of parts delivered with great accuracy by high capacity production machines; in other words, of checking at high speed and with extreme precision. Previous to mass production, in the days when both machining and assembly were in the hands of one operator, the latter used to measure the parts to be assembled and to conclude from this measurement whether or not their size was correct. Sometimes, he would even try out in what manner both parts would fit together, making thereafter the necessary corrections on their size.

The older method of checking the size of a part by measuring it, was obviously unfit to match in mass production the speed of inspection to that of machine output, unless several inspectors took care of the parts delivered by a single machine, a solution which would be incompatible with the principle underlying the use of production machinery, of saving human labor and time. In fact, this method consists of three elementary operations: first, adjusting the measuring device to the actual size of the part; second, reading the indication of the measuring device; third, determining whether or not the size is acceptable. (This would mean, in the case of interchangeable manufacture, whether the size indicated is within the limits.)

The first operation is a purely physical one requiring a certain number of motions. For example, a micrometer must be adapted, by screw displacement, to the diameter of a shaft or similar part. The second and third operations are mental ones, distinctly requiring, in addition to time, a certain care, as an error made in any of them will nullify the value of the checking operation.

The fact that the actual size of a part is of no primary importance with regard to its acceptability, the criterion being solely whether or not its size is within the limits, made it possible greatly to simplify the checking operation. If, indeed, the limits of a part were physically laid down in some kind of device by means of which the size of the part could be compared with each limit in a direct manner, that is through actual contact, the determination of the actual size of the part could be foregone.

LIMIT GAGES

This idea was embodied in "limit gages," measuring devices representing

the manufacturing limits of a particular part, or serving for several parts having the same limits. To take a concrete example: a common form of limit gage for the outside dimensions of a part, say the diameter of a shaft or pin consists of two cylindrical plugs whose diameters represent the high and the low limit of the hole respectively. The "go" plug can enter an acceptable hole, while the "not go" plug is refused.

Too small
(Part has passed both sets of points)

Acceptable
(Part has passed upper points, but hangs on lower)

Too large
(Part will not pass upper points)

INSPECTING A PART WITH A LIMIT SNAP GAGE *

or the thickness of a sheet of metal, is a so-called "snap gage" consisting of two pairs of jaws, each provided with two measuring surfaces. Two of these measuring surfaces are set apart a distance equal to the high limit of the part, the distance of the other pair equaling the low limit. Any pin passing between the measuring surfaces of the "high limit" jaws and not able to pass between those of the "low limit" jaws, obviously has an actual size lying between the limits and therefore is acceptable. The "high limit" set of surfaces of a snap gage are called the "go" side, the "low limit" set the "not go" side of the gage, a workshop terminology chosen in accordance with the manner in which acceptable parts behave with regard to each side of the gage. A form of limit gage extensively used for checking inside dimensions, as for example the diameter of a hole,

The "go" and "not go" sides of a limit gage together sift out the acceptable parts, in the same way as a pair of superposed horizontal sieves with a difference in width of mesh would single out, in the space between their levels, those particles of a granular material whose size lies between the two widths of mesh.

The manipulation of limit gages is very simple. A snap gage, for example, is let down on the shaft or pin to be inspected, and, if the part has an acceptable size, the "go" side of the gage will pass over the shaft, while the gage will remain suspended on the jaws of the "not go" side. If the part is a small one, the manipulation may be reversed inasmuch as the part is introduced between the jaws of the snap gage. In both cases, the operation involves but a few motions requiring no skill and only a small fraction of the

* Illustrations by courtesy of Greenfield Tap and Die Corporation.

time which a measurement of the actual size of the part would take.

The use of limit gages eliminates all of the three elementary operations involved in measurement of the size of the part referred to above. In fact, limit gages require no adjustment to the size of the part, nor the reading of any scale, nor the mental comparison of a scale reading with a specified size. Their check being immediate, automatic, on the basis of feeling instead of sight (and therefore less fatiguing) and requiring a minimum of time, physical and mental effort, and skill, limit gages represent from the point of view of inspection the counterpart of the machine-tools as producers of the parts. Both were developed to attain speed of operation, to save effort and to transfer skill. Mass production having the present degree of efficiency, inconceivable without the use of high capacity production machinery, would be equally unattainable, had not the introduction of limit gaging balanced the shape-giving and assembling processes as to the speed and labor saving factors.

Gages have been dealt with here solely from the viewpoint of mass production in the metal working industries, with which they are directly and intimately connected. Their significance is greater, however, for the reason that all manufacturing industries are dependent, to some extent, on the products of the metal working industries, in form of means for development and transmission of power, production and transportation equipment, measuring devices and instruments. All of these are wholly or partly built up by mass production processes in which gages play their part.

Methods of limit gaging, explained in this article with the aid of a specific example, may also be carried out by means of various other devices, which although different in form, are based on the same principle.

The Development of Safety Standards for Domestic Gas Appliances, by the American Gas Association

By R. M. Conner
Director, Testing Laboratory, American Gas Association

WHEREVER heat is required, the use of gas has constantly been increasing throughout the past century. Today, there are few industries that do not require heat as an absolute necessity. It is used in the home for warmth, for the preparation of food, and in affording many of the other essential conveniences of our present-day methods of living. Many health authorities are now advocating wider use of gas heat to avoid the smoke evil and other inconveniences connected with the utilization of most kinds of solid fuel.

Gas companies for many years have maintained appliance testing and research laboratories of their own. Their activities, however, have had for their object the solution only of their local problems. Until recent years no particular thought or effort was given to the subject of national control.

As early as 1915, plans were under way for the preparation of national standards governing the performance and construction of gas appliances and the establishment of some national testing agency to enforce them. Definite action at that time, however, was postponed by the beginning of the World War, and it was not until the year 1924 that this subject was again taken up for serious consideration.

Preparation of Requirements

The fundamental principles governing the utilization of gas were first set forth in the Gas Safety Code, a manual prepared jointly by a committee representing the U. S. Bureau of Standards and the American Gas Association. Work of preparing the Code began in 1915, and was pursued intermittently until 1920, when it was turned over to the American Engineering Standards Committee for completion. In December, 1925, it was approved as a tentative American Engineering Standard and in 1927 became an American Standard. All of the various appliance or installation requirements are prepared to conform to the rules of the Gas Safety Code.

It was entirely in accord with the spirit of the American Gas Association, as expressed in its constitution:

> To promote and develop the Gas Industry and to coördinate its activities to the end that it may serve, to the fullest possible extent, the best interests of the public.

That the Association in 1924 took over actively the task of preparing and enforcing safety and construction requirements to apply eventually to all types of domestic gas burning appliances. In this program it was assisted greatly by the U. S. Bureau of Standards through its Gas Section, which had been actively interested in the utilization of gas for many years.

The problems confronting the American Gas Association were twofold: First, to determine and set up stringent safety, and reasonable construction standards to be applied nationally, and, second, to provide some agency for enforcing them.

An approval requirements committee composed of representatives of the U. S. Bureau of Standards, U. S. Bureau of Mines, U. S. Public Health Service, and the Master Plumbers' Association, as well as an equal number

of gas company and appliance manufacturer members, was appointed to perform the first duty. To apply the standards, or requirements as they are now called, prepared by the various committees, the Association established a Testing Laboratory in Cleveland, Ohio. The activities of this institution were placed under the supervision of a Laboratory Managing Committee.

Requirements are prepared by the Approval Requirements Committee, which receives major assignments from the Association and delegates this work, with the exception of the preparation of requirements concerning completeness of combustion, to sub-committees. The requirements dealing with completeness of combustion are prepared by a Safety Committee composed of representatives of the U. S. Bureau of Standards, U. S. Public Health Service, U. S. Bureau of Mines, and the American Gas Association. The research necessary in the preparation of safety requirements is conducted jointly by the A. G. A. Testing Laboratory and the U. S. Bureau of Standards at Washington, D. C.

REQUIREMENTS FOR COMPLETENESS OF COMBUSTION

Among the first problems confronting the Appliance Committee was the consideration of a requirement for completeness of combustion, *i.e.*, determination of the carbon monoxide concentration human beings can breathe over a given length of time without any harmful effects. The following table, compiled from the findings of Dr. Yandell Henderson,[1] show the experimental effect of various concentrations of this gas:

TABLE I—EFFECT OF CARBON MONOXIDE FOR A GIVEN TIME ON HUMAN BEINGS

Concentration of CO in Per Cent	Effect of CO in a Given Time		
	One Hour	Two Hours	Three Hours
.01	None	None	None
.02	None	None	Slightly perceptible
.03	None	Just perceptible	Headache and nausea
.04	None	Headache	Headache and nausea
.05	Slightly perceptible	Headache and nausea	Dangerous to life
.06	Just perceptible	Headache and nausea	Dangerous to life

The above table was confirmed by Messrs. Sayers, Meriwether, and Yant[2] of the U. S. Bureau of Mines, who also compiled the following table:

[1] Journal of Industrial Hygiene, III, Nos. 3 and 4, 79-32 and 137-146.

[2] Public Health Reports, 37, No. 19, May 12, 1922, p. 1127, Reprint No. 748.

TABLE II—AFTER EFFECTS OF CARBON MONOXIDE FOR A GIVEN TIME ON HUMAN BEINGS AT REST AND EXERCISING STRENUOUSLY

Concentrations of CO in Per Cent	Subject at Rest				Subject Exercising Strenuously One Hour
	One Hour	Two Hours	Four Hours	Six Hours	
.02	None	None	None	None	
.025	.....	.....	.....	.....	Very mild to moderate
.03	.....	.....	Mild	Moderate	
.033	.....	.....	.....	.....	Mild to moderate
.04	Moderate	.....	.....	.....	Moderate

Apparently these authorities agree that a person exercising or resting when breathing an atmosphere in which there are present three parts of carbon monoxide in 10,000 suffers no effects.

CONDITIONS OF TEST

Since all requirements were to be national in scope, the next problem with which the Approval Requirements Committee was faced was the establishment of tests that would subject gas appliances to the various conditions of gas service existing throughout the United States, for it was obvious that any appliance operating perfectly on one kind of gas and under one pressure might be a real offender under other conditions. For this reason it was apparent that a high degree of flexibility must be insured.

On investigation it was found that usual gases delivered to domestic consumers throughout the United States vary in heating value from about 400 to 1200 Btu. per cubic foot, in specific gravity from 0.35 to 0.70, and are supplied at varying pressures. While it was obviously out of the question to test each appliance under every possible service condition, it was found that the most severe conditions ordinarily encountered in service might be determined and their effect on gas appliance operation anticipated. A careful survey indicated that, by testing with a 1100-Btu., 0.7-specific gravity natural gas at 7 inches water pressure, a 450-Btu., 0.7-specific gravity water gas at 3.5 inches pressure, and a 550-Btu., 0.37-specific gravity coke oven gas at 3.5 inches pressure, results could be obtained that would be indicative of appliance operation under the most extreme conditions of service.

In addition to tests for completeness of combustion, under the above conditions, it was decided that pressure variations of 50 per cent above and below normal should be used to insure a wide degree of flexibility in meeting varying pressure conditions. Therefore, tests were specified under the most extreme conditions that appliances are ordinarily called on to meet anywhere in the country, so that appliances complying with such requirements would prove even more satisfactory under usual service conditions.

Committees interested in the development of combustion requirements have always felt that the production of carbon monoxide should not be permitted during the operation of an approved appliance. At the time this subject first came up for serious consideration, apparatus for the detection of this gas was not nearly as accurate as it is at the present time, one part of carbon monoxide in 1000 representing the greatest sensitivity obtainable. However, with the aid of machines recently developed by the U. S. Bureau of Standards and the U. S. Bureau of Mines, it is now possible to detect concentrations of carbon monoxide as low as one part in 1,000,000, and to determine it accurately in amounts as low as two parts in 100,000.

Most of the requirements dealing with completeness of combustion have been prefaced by the notation "no carbon monoxide shall be produced." Interpreted literally this means that one part in a billion or even in an infinite number of parts would not be permitted. Such a requirement, however, would obviously be ridiculous, for such quantities and often much larger ones are present in the air that we breathe. The research work summarized in the tables prepared by Henderson and Sayers, Meriwether, and Yant, clearly indicates that it would be absolutely unnecessary to propose any such high degree of refinement.

In establishing the requirements the various committees took into consideration the relative degree of hazard connected with the operation of each appliance.

Therefore, the combustion requirements differ for various appliances on account of their different methods of use. Thus it is that the requirements for space heaters are exceedingly strenuous whereas those for gas ranges, which are more or less intermittently used, are less severe. For water heaters and central house heating appliances, which are normally connected to a flue, higher concentrations are permissible than for space heaters. All such requirements and their methods of derivation, some of which are rather complicated, are set forth in the various A. G. A. Approval requirements, copies of which can be secured either from the American Gas Association, Inc., 420 Lexington Avenue, New York, N. Y., or the American Gas Association, Inc., Testing Laboratory, Foot of E. 62nd Street, Cleveland, Ohio.

PREPARATION OF OTHER REQUIREMENTS

To ensure safety of operation there remained further to establish requirements for fire hazard, leakage, and explosion.

The requirements for fire hazard were adopted from data established by the National Board of Fire Underwriters. These standards are expressed in the allowable rise above room temperature when the appliance is operating in a partial enclosure formed by two walls and placed six inches from each. The limit is 90 degrees Fahrenheit above room temperature, which is far enough on the side of safety to meet satisfactorily an occasional improper installation.

Requirements for many constructional details governing the minimum seal, both vertical and circumferential, and take-up for gas cocks, as well as the tightness of other parts were made to insure against leakage of raw gas. Every appliance meeting the approval requirements of the American Gas Association must be provided with or have incorporated in its construction an explosion relief which, in the event of an accidental explosion, will provide every reasonable precaution to prevent injury to the user.

There are also many other requirements which a domestic gas appliance must meet in order to receive the approval of the American Gas Association. Gas ranges, for example, must successfully pass more than 160 tests, 90 per cent of which are to insure appliance safety. The requirements for tests other than for safety from carbon monoxide are prepared by sub-committees composed equally of gas company members and members manufacturing the types of appliances for which the requirements are being prepared.

In the preparation of all requirements the necessity of providing every opportunity for manufacturers to improve or better appliances and to embody individuality in their construction is carefully considered. It has been the constant aim of each committee to avoid retarding progress that would in any way effect greater convenience and safety or economy in the cost of production.

Before being adopted, requirements are submitted in tentative form to the entire gas industry for criticism and, after final adoption by the A. G. A. Approval Requirements Committee, following a tentative period of from six months to a year, become mandatory. In this manner approval requirements have been prepared for flexible gas tubing, gas ranges, space

heaters, water heaters, and central house heating appliances. At the present date tentative requirements have been issued for hot plates and laundry stoves, and others for clothes dryers and incinerators are under consideration.

Because it is difficult to obtain the best performance from gas appliances unless they are properly installed, the American Gas Association has also prepared and issued tentative requirements for house piping and appliance installation. These are so written that they are applicable nationally and are sufficiently general in nature to permit the continuance of local policies that are in accordance with generally recognized rules of good practice. They specify general rules to be followed and present recommended methods for placing such rules in effect.

Along with its efforts to improve the standard of appliance construction and operation, the industry has given attention to the best methods of resuscitating persons from asphyxiation. During the year 1921 a special commission of medical authorities was appointed and charged with the duty of investigating resuscitation measures then available and of recommending the best first aid and resuscitation measures in the cases of gas asphyxiation.

In 1923 the Commission made its final report which outlined the experiments performed, and recommended the Schaefer Prone Pressure Method supplemented by the use of the oxygen-carbon dioxide inhalation treatment under appropriate circumstances.

The Commission also tested and gave its approval to certain inhalators designed to administer the carbon dioxide inhalation treatment.

More than 200,000 copies of the recommendations of this Commission have been distributed and its work has been a tribute to the foresight of those who were instrumental in its formation.

The work accomplished by the Commission may be divided into two definite parts. The first dealt with the general status of the problem of resuscitation from gas poisoning, together with an analysis of certain features of resuscitation as then practiced which were felt to be poorly understood and possibly harmful. The second and more important part of the work referred to a new and more efficient means of resuscitation, viz., the inhalation treatment utilizing oxygen-carbon dioxide.

Since the final report of the Commission, field surveys have been made to determine the efficiency of the oxygen-carbon dioxide inhalation treatment for resuscitating persons overcome by asphyxiation, which confirm the effectiveness of this treatment.

In the belief that with the growth in the use of the Schaefer Prone Pressure Method nationally, uniform training of employees would result in a greater saving of human life, the Association has been active in urging the preparation of a standardized text describing the application of the Schaefer Prone Pressure Method. This movement was conducted under the auspices of the United States Public Health Service and agreement has recently been reached on a standardized text by eleven national organizations interested in this subject.

APPLICATION OF REQUIREMENTS

The various requirements are applied for the gas industry by the American Gas Association, Inc., Testing Laboratory established at Cleveland by contributions from members of the Association. It was located in Cleveland because this city is near the geo-

graphical center of the gas appliance manufacturing industry and because it has so many base gases available for testing purposes. It is the most completely equipped gas appliance testing laboratory in the world, and contains many delicate and accurate instruments which, in the hands of a staff of trained testing engineers, make possible the most accurate determinations desired.

To determine the concentration of carbon monoxide in the products of combustion of gas appliances under test, the Laboratory uses the most sensitive and accurate instruments known, namely, the iodine pentoxide apparatus, the carbon monoxide recorder, and the conductivity carbon monoxide and carbon dioxide apparatus. With the aid of these instruments it is possible to detect carbon monoxide accurately in concentrations as low as two parts in 100,000. Much of the Laboratory's equipment has been developed by the Laboratory to apply with a greater degree of certitude the approval requirements for safety and efficiency in gas appliance performance.

Appliances are submitted by manufacturers to the Laboratory for test in accordance with the approval requirements. If an appliance is approved, the manufacturer is permitted to display on it the Laboratory's copyrighted seal of approval, which consists of a circumscribed blue star, and the model is listed on the Laboratory's "List of Approved Appliances" furnished all Association members. This list is revised and issued each month. By this means the industry is kept informed of all appliances having the Laboratory's approval, and the Laboratory is able to recognize and correct any unauthorized use of its approval seal. Approved appliances are further identified by "Certificates of Approval" issued by the Laboratory.

Approval is granted an appliance for one year only—that indicated on the face of its certificate of approval. Approval is extended at the beginning of each year only if the appliance is found, by an inspection at the factory or in the field by a Laboratory representative, to be of the same construction or superior to that originally passed by the Laboratory.

The ultimate result desired by the gas industry—and one which is not incapable of attainment—is that, by the adoption of its approval requirements and the establishment of an agency to stamp meritorious gas appliances, it will eventually become impossible to purchase any domestic gas appliance not certified as safe, efficient, and reasonably durable.

By this means, the American Gas Association hopes to have taken a big step toward the realization of its aim to "serve to the fullest possible extent the best interests of the American public."

The Present Status of Standards in the Electrical Industry

By C. E. Skinner

Chairman, American Engineering Standards Committee, and Assistant Director of Engineering, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.

THE electrical industry, while less than half a century old, is one of our greatest industries and its phenomenal rise has been due in no small measure to the early adoption of fundamental standards. It is an outstanding example of the fact that proper standardization does not hinder but aids development. In every industry, and particularly in those which undergo rapid development, a very wide variety of devices, methods and practices are tried out, before the survival of the fittest indicates the direction which detailed standardization should take. It is of incalculable benefit, however, to such an industry to have the fundamentals underlying that industry stabilized by standardization at an early date. Fortunately for the electrical industry, the American Institute of Electrical Engineers early undertook such standardization, organizing their first Standards Committee in the year of 1898. Their early work was devoted to the arriving at standards governing the basis of rating, basis of test requirements and similar items.

Development

In the rapid development of the electrical industry, however, many divergent practices deemed necessary at the time were developed, which in the light of later developments were found to require modification. The Standards Committee of the American Institute of Electrical Engineers has in the past been the leader in developing and adopting standards, particularly those which relate to fundamental practices. The Bureau of Standards in Washington, in coöperation with foreign countries, has done its part in the establishment and maintenance of fundamental units used in the industry, such as the volt, the ampere, and the ohm.

Of later years, trade associations of the manufacturers and the users have arisen, which have found the establishment of certain additional types of standards to be a major service to their groups. Meanwhile, electrical devices have found their way into almost every possible phase of our modern life with its ever increasing tendency to complexity. The development of new uses for electric current and new applications of electrical devices has gone forward in geometrical ratio. All of this makes it more and more necessary to carry on a continuous program of standardization in the electrical field to prevent utter confusion in all of those phases of the electrical art, which touch our daily life. Much has been done in the past to provide us with our common devices and to insure common practices which shall give the maximum service efficiency at a minimum of cost. Much remains to be done. We are much more fortunate on the whole, perhaps, than our European friends, due to conditions and practices which will be briefly outlined.

In the beginning of an industry, the standards are very largely governed by the manufacturers, and fortunately for the United States there were few manufacturers engaged in the production of

electrical apparatus so that relatively few voltages, frequencies and types of systems found their way into service. Primarily, electric current was used mainly for lighting, and the distributing voltage for lighting circuits was fixed in most of the early plants at 110 volts. There were various types of apparatus and methods for the producing of electric arc lights, but these have practically disappeared with the advance in the incandescent lighting art, so that they need not be considered. With the manufacture of carbon filament lamps, it was found impossible to make all lamps, or even a very large percentage, suitable exactly for a given voltage, and consequently, the practice grew up of sorting the lamps to their best operating voltages. Different districts in the United States were asked to adopt voltages varying from the initial standard of 110 in order that economical use of the lamps thus produced might be met. This brought about a considerable number of voltages varying by a few per cent from the originally adopted standard. In addition, certain variations were made for reasons of economy in wiring, or for maintaining satisfactory service. With the advent of the metal filament lamp, the difficulty due to variation in lamps disappeared, removing this obstacle to a universal standard distributing voltage.

VOLTAGE STANDARDS

At about the same time, household devices of many types and varieties began to appear. These required for their economical manufacture in quantity, the closer adherence to a given voltage. This was particularly true of those devices such as certain heating devices, whose performance varied widely with a small change in delivered voltage. Furthermore, the devices, such as transformers which supply the service circuits would be simplified by the adoption of a standard voltage. These considerations and others, perhaps less important, led to an extended study of the delivered voltage situation with the result that a few years ago, the standard of 115 volts for distribution circuits was adopted with 110 and 120 as recognized departures. Recent studies indicate a rapid decrease of the number of distribution systems employing 110 volts and a considerable increase in the number of 115 volts and a slight increase in a number of those employing 120 volts. This has made it possible for the manufacturers of lamps to largely concentrate on these three voltages and has been of very great benefit to the manufacturers of those devices, used in large quantity, which are sensitive to voltage conditions. Certain devices used largely on distributing circuits, particularly in household service, operate fairly satisfactorily over the entire range, but naturally each has its best particular operating voltage. It may be said, therefore, that we have been rapidly arriving at a standard which may possibly become universal throughout the United States for distributing voltages which are supplied to the mass of our people and particularly for their lighting and domestic appliances.

In general, as a matter of convenience and economy, the voltages for appliances using more power than the usual household device, particularly motors, have usually been a multiple of the distributing voltages for lighting, that is, if 115 is the standard lighting voltage, the motor voltage from the same system would be 230; distributing voltages for factories, mills and still larger users might be still higher. Unfortunately, from the viewpoint of standards, it has been found in recent years that wiring systems, particularly in congested districts in the cities, can be improved with regard to continuity

of service and cost of installation, by a modification of connection such that, with standard lighting voltage, the motor voltage available becomes an off-standard, or vice versa. For example, with 115 distribution voltage for lighting and general household appliances, the motor voltage on these new networks would be 199. This brings in a new phase of the question in which the previous standards may possibly require additional standards in the interest of matters which outweigh the value of maintaining a single standard. The motor standard outlined above may have to be changed for densely populated districts, while the old standard would remain for outlying and less congested areas.

All of this must eventually be tied up with the whole distributing system from the utilization device back through the secondary distribution, through the primary transmission and to the generating stations. The interested parties, that is, the public utilities, the electrical manufacturers and others, are attempting to bring about an orderly set of standards of voltages from the generating station through all of the transmission to the individual users' premises. There is a vast amount of engineering involved in this simple requirement, but there is every evidence that this most desirable object will be achieved at least to a degree which will provide for a more orderly procedure in the manufacture and installation of electrical machinery and devices.

In Europe there are many distributing voltages, but the more usual standard is 220. Consequently most utilization devices satisfactory on circuits in the United States will be destroyed if it is attempted to use them on many European circuits. Numerous instances of burned-out curling irons, smoothing irons, etc., carried to Europe by American travelers are on record.

Alternating Current

Alternating current has become almost the universal kind of current used for the general distribution of electrical energy. Its ascendency over direct current distribution is due to the facility with which it may be changed from one voltage to another and the fact that utilization devices employing alternating current have been developed for almost every possible application. Recent developments in the interconnection and extension of existing systems to cover very large areas so that any given point may be served by the most efficient generating station connected to the system, has resulted in very great economies in distribution and transmission and has insured a continuity of service such that outage at any given point is now a very rare occurrence. This interconnection is made possible, due to the fact that in the United States we very early standardized on two main frequencies, namely 25 cycles per second and 60 cycles per second. Numerous other frequencies were adopted in the early days but, with the exception of a very few 50-cycle plants, these have all disappeared. In the early development of certain apparatus, such as the rotary converter, it is found difficult to design these for satisfactory operation on 60-cycle circuits, and this is the main reason for the adoption of the 25-cycle circuits. Later this design difficulty was overcome and in the distribution systems in the United States, 60 cycles very largely predominates. Twenty-five cycles is still found necessary for direct application of alternating current to railway electrification.

Standard Frequencies

The adoption of standard frequencies has made it possible to manufacture equipment suitable for these frequencies which can be used in prac-

tically any part of the United States. A multitude of frequencies would have made interconnection of systems as practiced at the present time, sometimes over areas of many thousands of square miles and transfer of power over hundreds of miles, economically impossible. Interconnection in systems of different frequencies may be made by use of frequency changers, but these are expensive and are used only in certain limited applications.

In Europe there are many frequencies in use, but the prevailing standard is 50 cycles in place of our 60 cycles and, for railway and similar work, 16⅔ as against our 25. In the city of London, alone in the past, there have been a large number of relatively small plants different both in frequency and voltage, and this has done much to retard the use of electrical devices in the London area. If one moved from one district to another, an entirely new set of devices might be required. Plans are on foot for adopting a standard voltage and frequency for this district which will mean the scrapping of much of existing equipment.

STANDARDIZATION OF LIGHTING DEVICES

In the beginning of the incandescent lighting industry many types, styles and varieties of lamps, bases and sockets were developed. The standardization of lamps, bases and sockets, has proceeded to a point where we now have but one base and socket for all ordinary incandescent lamps, and a recent further standardization reduced lamp sizes for ordinary work to five. This has made it possible for the manufacturers of these devices to turn them out by hundreds of millions per year, with a constantly increased efficiency and a more or less constantly decreasing cost to the customer. The cost of illumination in terms of current purchased by the householder has, through this standardization and through increased efficiency of illuminating devices, been almost constantly decreased, since the beginning of incandescent lighting.

There are, of course, additional types of lamps, such as miniature lamps, automobile lamps, high-power street lamps, etc., and these require both smaller and larger sockets and bases than the general standard. These are also rapidly approaching standardized forms in the fewest possible number. A lamp manufacturer in Europe reported that he was required to make over 70,000 sizes, types and varieties of incandescent lamps in order to service the general European trade. This, of course, includes every variation in size, voltage, type of base, color of glass, etc. This makes a very difficult manufacturing proposition.

THE NATIONAL ELECTRICAL CODE

Very early in this country the Underwriters' found it desirable to require a high grade of electrical construction to lessen fire risks in insured properties. The National Electrical Code is the result of this work and this Code, revised and brought up to date from year to year, largely governs electrical installations, especially wiring and wiring devices throughout the United States and Canada. This Code really sets a standard which has been of very great benefit to the whole electrical industry, providing as it does for safe practices, thereby giving confidence in the use of electrical devices.

The National Electrical Safety Code, of more recent origin, does the same service to industry with regard to the life hazard as is done by the National Electrical Code with regard to the fire hazard. With the application of electricity to almost every service in industry and in our homes, it is evident that

such standards guarding the fire and life hazards are essential. These standards have done much to standardize the devices and materials used in wiring construction, and this again has been of great benefit to both their manufacturers and users.

PRACTICAL STANDARDIZATION PROJECTS

During recent years, the work of the standardizing groups in the electrical industry in the United States has been extended to the bringing about of practical standards covering the majority of the general types of electrical apparatus made and sold. The national engineering body in the electrical industry, namely the American Institute of Electrical Engineers has been the leader in these standardization projects. Trade associations, such as the National Electrical Manufacturers Association, the National Electric Light Association, the American Electric Railway Association, the Association of Iron and Steel Electrical Engineers and others have taken part in such a standardization or have had standardizing projects of their own. These standards include nomenclature, definitions, bases of rating and tests, dimensional standards and many others. Many of these standards have been submitted to the American Engineering Standards Committee for the stamp of approval as American Standards. This standardization work has involved an immense amount of time, labor and expense, but that it is deemed essential to the advancement of the electrical industry is evidenced by the support which has been given by all parties at interest to this great standardization movement.

PROGRESS IN THE INTERNATIONAL FIELD

In the international field, the International Electrotechnical Commission, organized a little over twenty years ago, has done much to bring about international accord, particularly in arriving at those fundamental standards of units, bases of rating, and such other items as make it possible for a purchaser in any country to intelligently prepare bids for equipment made in accordance with the specifications of any other country. This international work has included in addition to those items which are fundamental in the evaluation of the rating of electrical machinery, such items as the standards of prime movers for driving electrical equipment, and the rating of rivers with regard to their power resources. At the World Power Conference in 1924, most of the power using and power producing countries of the globe gave estimates of their power resources. In many cases, water resources were not comparable, due to the fact that the rating of water powers was estimated on different bases. The effort originating in America and sponsored internationally by the International Electrotechnical Commission to arrive at a definitely understood method of rating of rivers and water powers the world over will make it possible to make direct world wide comparisons along this line.

GENERAL VALUE OF STANDARDIZATION

Standardization in any line is of value to all parties at interest, that is, the producer of devices and machinery involved, to the producers of distributors and especially to the ultimate users. In the electrical field, standardized voltage frequencies, types of apparatus, standard ratings and dimensions, make it possible for the manufacturer to produce in quantity at minimum cost, devices of maximum efficiency and quality. It permits the public utility to purchase the apparatus necessary for the production and distribution of electric current at mini-

mum cost and of a type which will be suitable in any situation which may arise. It makes possible for the user of electric current and electrical devices to secure the best possible and of the type which may be utilized on practically any circuit in the United States. It is impossible to estimate the money value of the standardization already accomplished, but it may be said without fear of contradiction that the use of electrical current and devices in this country in far greater measure than any other country of the world is in no small part due to the standardization already accomplished. There has certainly been no detrimental effect on the development of the electrical industry by this standardization and the extensive work planned for the future is ample evidence of the value the industry as a whole places on standardization.

Standards in the Printing Industry

By Mr. Russell A. Pettengill
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IN approaching the above subject it seems necessary that we consider it from a most liberal angle, which is at the same time from an engineering point of view.

First, to avoid misunderstanding, let us define our subject according to Webster:

1. A standard is that which is established by authority, custom or general consent as a model or example; criterion test.
2. Printing is the act, art, practice, or business of one who, or that which, prints; typography.
3. To print—to stamp or impress with characters, patterns, or the like. Transferred by pressure from plates, types, etc.
4. Industry—any department or branch of art, occupation, or business, especially one that employs much labor and capital.

From this printing can be classified as an industry, although we have heard it debated that the large number of establishments, 21,000 in all, would not allow it to be considered as such. But more important still, we establish the fact that a standard is that which is established by authority, custom or general consent as a model; furthermore, that printing classes as an art. It is upon these facts that we will base this article.

Unlike most industries the printing industry serves as an adjunct or supplement. It is dependent for the most part on general industrial conditions, for printing is a medium of expression that reflects and fosters these general conditions. On the other hand, "The Art preservative of the arts," as it has often been called.

It is through printing first that we have a record of History, of Literature and of Art; without printing there would be little learning. There would be no trade. Civilization could not have advanced. Business could not have developed. Advertising would be unknown. Its importance, therefore, cannot be denied, and its value must be given full appreciation—its standards understood.

Standards in Printing

The first and most important standard in printing and the standard to which perhaps the least thought is given is the standard of typography. The second standard of printing was laid down by our early printers, the standard of quality, or shall we say permanency or value? It seems proper, therefore, that we should not overlook these two standards: first, the standard of typography and, second, the standard of quality, permanency or value. And since a standard is that which is established by authority, custom or general consent, we must understand what this model is.

History and Expansion

Between 1448 and 1456 John Gutenberg, a citizen of Mainz, was engaged in printing a book that has been called either the *Mazarin*, *The Forty-Two-Line*, or the *Gutenberg Bible*. This book comprises two volumes of 1282 pages 16½ by 12 inches. There are forty-one copies in existence today. The letters are Gothic in imitation of the prevalent manuscripts. The quality of the printing established a standard. It meant the death of the Scriv-

ener within half a century. (Its money value today is approximately $200 a page.)

Gutenberg was financed by Fust, a Jewish money lender, and aided by Peter Schoeffer, who later married Fust's daughter, Christina, and became the most distinguished printer in Germany. The probabilities are that Gutenberg was an indifferent executive, for the *Gutenberg Bible* is believed to have been completed by Schoeffer. The firm of Fust and Schoeffer published in 1457 a psalter considered by many as an outstanding book in the annals of typography. The initial letters imposed in two colors, red and blue, are registered with such accuracy that expert typographers disagree as to whether they were stamped or printed. The high character of quality is a credit to the executive ability of the master craftsman, whosoever it was that completed the work. And yet there is no doubt that these two early works were the result of an effort to earn money.

The process of printing was kept a secret from the world until 1462, when Metz was sacked and the employees of the firm of Fust and Schoeffer took their knowledge to other parts of Europe.

In spite of obstacles imposed by Scriveners, Church or State, the early growth and spread of the printing craft was rapid. This can be understood better from a more detailed account.

In Germany by the end of the century there were 16 master printers in Strassburg, 22 in Cologne and 20 in Augsburg.

The Netherlands claimed 21 towns with printing establishments, France 31, Italy 32 and Spain 21.

Printing grew into a thriving craft within a period of forty years primarily because it met with an economic demand.

During the succeeding three centuries the printing craft and trade expanded in size, but showed a tendency to confine itself to the printing of books.

The early plant usually utilized a press made after the fashion of an old wine press. The "bed" of the press was immovable. The form was laid face upward upon it, and when the sheet of paper was placed over the inked form the screw was turned and the movable plate came down upon the paper, making the imprint. Although the type was made of tin or copper, the immobile base beneath it made it necessary for the printer to be extremely cautious in applying the pressure from above in order to prevent the crushing of the type. Yet the early printers showed great skill in manipulating the device, for their volumes, especially books of early Italian printers, show that the imprint was registered on the sheets cleanly and with equal margins. Books were bound in boards the thickness of a door panel. Designs were studded on these covers with brass tacks or engravings. It is little wonder that Erasmus once said of Thomas Aquinas's *Secunda Secundae*, a rather long work, "No man can carry it around with him, much less get it into his head."

Master craftsmen controlled printing until about 1600—but even then the domination of the publisher became apparent—as illustrated in the great Leyden firm of Elzevir that published what has been called the Everyman's Library of the Seventeenth Century.

The house of Elzevir is generally associated with decadence in the quality of printing. Here we find business interests neglecting quality because the executives knew and cared little about the technique of printing. To compare the product of the Elzevir firm with that of Fust and Schoeffer, it must be done first on a basis of spacing, leading,

indentation, ink, paper, imposition—design and decoration—and then how well does the work fulfill its purpose?

In a background where relief printing, paper, printed books, wood engravings and the idea of movable types already existed, "Gutenberg's invention consisted apparently in making brass moulds and matrices by which type could be cast in *large quantities*," as brought out by Updike in his authoritative book, *Printing Types*. Thus the Gutenberg legend is reduced to a successful demonstration of a mechanical means for the reproduction of manuscripts. Use of the principle of typography, then, movable metal type cast in a mould from a matrix, is the beginning of printing as we know it today.

Principle of Typography

Since the days of Gutenberg the principle of typography has been improved upon in detail only. In theory the principle of typography is essentially the same. Today it remains an integral part of all branches of the printing industry from the printing of books to the manufacture of postage stamps. Using the term in its broadest sense, which includes the planning of printing, typography is the key to the study of all phases of the industry today. Its relation to advertising has emphasized its commercial importance to such an extent that trade papers refer to it as a profession.

Mr. Updike's significant comment adjusts our point of view, "Typography is an art and Typography is a trade; not to face these two facts or to neglect either one of them is merely to fool one's self."

The history of printing, however, reveals few typographers worthy of the name of artist. For as an art it has been and is understood by few. John of Spira and Jenson were innovators in changing Gothic type to Roman in 1469 and 1470 respectively. John Day followed their example almost a hundred years later in England. Aldus, in 1501, is said to have invented the italic; the Earl of Ratdolt, the first title page in 1476; while Platin used the engraved title page for his famous Polyglot Bible in 1572. Garamond in France specialized in type cutting about 1540, and Caslon is known as the great English type founder of the eighteenth century. The Italian, Bodoni, designed the "Modern Face" type in 1789. Bruce Rogers and Mr. Goudy are outstanding in American type design. There are many more whose names should be bywords with printers: Caxton, Pigouchet, Estienne and Froben. Many works should be known as well: woodcuts for the *Nuremberg Chronicle* of 1492 by Michael Wohlgemuth and Wilhelm Pleydendorf, woodcuts by Albrecht Pfister of Bamberg, woodcuts by Laboureur—engravings from Boucher, Burne-Jones, Gravelot and Eigen. In short, decoration from the *Hypnerotomachia Poliphili* of Aldus to the Locomobile ads of T. M. Cleland—the *Saturday Evening Post*, the *Gazette du Bon Ton*, or the *Blatter fur die Kunst*.

Like Geoffrey Tory, artist, scholar painter in sixteenth-century France, William Morris in the last decade of the nineteenth century did much to elevate the standards of quality in printing. His influence is felt today on the continent, at home in England, and in America.

Quality of Printing

To maintain and surpass the quality of printing as set by standards of the past is a worthy aim. It can be accomplished through a more widespread appreciation of typography. A better understanding between the producer and consumer of printing is required. To a large extent the public is in itself

the criterion of taste, but we underestimate the average intelligence. We all admire a beautiful building, but when we build, our work does not usually qualify as an outstanding example of architecture. Most of us obtain a great deal of satisfaction out of a perfectly appointed room—one that has the comfortable feeling of home and yet has enough in quality and taste to make no error. Perfection in any art is but a fleeting hope—unless systematically studied and attained. So it is with typography.

Typography is but typesetting—architecture only drafting. And yet typography is an art to be enjoyed and taught.

A discussion of art, however, enters upon an ephemeral field. In a comparison between the *Gutenberg Bible* and a book produced by the Elzevirs, we have the common basis of typography. We find that the quality of printing in either case is dependent upon the executive in charge of the individual plant. In general since 1600 the quality of printing has suffered, because since 1600 the printer, like his trade, has been dominated by other interests. A higher order of executive is essential to a higher order of quality in printing.

On the other hand, many have been employed in typography as a trade, a fact that gives point to the words of Antoine Vitré, favorite of the famous Cardinal Richelieu:

> Letter founders call themselves publishers, printers, and binders because they cast letters for books. I tell them that the calf has about as much right to call himself a publisher because he furnishes the skin for the binding.

This witticism from the seventeenth century is indicative of a general change in the printing industry—the advent of specialization.

Subsequent development in printing has been along the line of specialization. This fact must be considered in applying the word quality to printing as an industry.

We have discussed the two primary standards of printing, that of typography and that of quality. From tradition we find the principle of typography—movable metal type cast in a mold from a matrix—is the basis of all printing. In the history of printing, only a few typographers excel.

The quality of printing is dependent upon the individual or group of individuals who control the manufacture (men, material, equipment) and marketing of the finished product. In general since 1600 the quality of printing has suffered, because of the subjection of the average printer.

DEVELOPMENT IN THE PRINTING INDUSTRY

The last thirty years have shown a remarkable development in the printing industry, and the recognition of the value of standards has been definitely shown. Great credit is due in this development period to many outstanding men and concerns, particularly in the field of printing equipment. Each large manufacturer of presses, of typesetting machinery, the type founders, the manufacturers of big bindery machines and other binding equipment, including folders and automatic feeders, have played their part. Farseeing printers have shown remarkable development, and to these we owe our inspiration and hopes for the future. We must as well recognize the manufacturers of ink, the large and progressive paper mills, the trade publications in the printing industry, the United Typothetae of America and the men in this organization who have devoted themselves unselfishly to their work. The United States Department of Commerce, the Bureau of Standards and the

Government Printing Office have also played their part, but the surface is barely scratched when we consider conditions existing today from an engineering standpoint.

The foregoing serves to tell us something of the history of printing through the centuries. The present is but a fleeting moment; the future, however, stretches before us as of outstanding importance.

STANDARD OF MANAGEMENT

A standard or model of management is the industry's greatest need. The thinking printer, leaders in the printing industry, realize this. But unfortunately the thinking printer or the leader is the exception. The average printer may point out this or that example—here or there where a man by his dominant personality has made a sensational success. The average printer, however, fails to realize that this or that man whom he cites would be successful in any enterprise—by virtue of his dominant personality. Such printers are very much like Napoleon and his Empire. The fall of Napoleon meant the fall of the Empire. Just so with printers where organization is subservient to personality: only too often the death of the man at the head has caused the dissolution of the business. Unfortunately too many successful printers are of this type. And therein is the need of a more general recognition of a standard or model of management. The institution established by such a personality outlives its founder only where the value of engineering is recognized and applied.

The maintenance of a standard of quality—the future of printing as an industry or, briefly, the establishment of a standard or model of management—depends upon a more general recognition of the value of engineering—a knowledge of what engineering really is. With this in view we will discuss the present status of printing, as well as its needs for the future.

It is important when criticising, whether this criticism be of the individual, company, companies, group of companies or an industry, that our criticism should not be destructive. We must, therefore, have in mind a remedy that our criticism may have some constructive result.

MAGNITUDE OF THE INDUSTRY

In order to realize the magnitude of the printing industry it should be noted that the printing and publishing industry consumed raw material valued at $610,059,000[1] and added to this, by manufacture, the value of $1,659,579,000 to produce total products valued at $2,269,638,000.[1]

The printing and publishing industry today has 21,000 establishments. The industry ranks fifth in the value of the total products sold, although actually, it ranks first in the amount of value added to the raw product in the period of conversion. It therefore in all probability has the highest payroll of any industry in the country.

Just consider for a moment the fact that the automobile industry, which ranks first in value of total product sold, although with a somewhat smaller payroll than the printing industry, has but 279 establishments as compared to 21,000 in the printing industry.

STANDARD OF MANAGEMENT NEEDED

In 21,000 printing establishments in the United States today, large plants and small, doing newspaper, magazine, book and job work, *management* is the most variable factor. Individual plants offer examples that range from best to worst. The average plant offers a low order of management. In 1921 a survey made by the Federated

[1] U. S. Census, 1925.

American Engineering Societies, on the elimination of waste in industry, found 63 per cent of the determined waste in the printing industry due to this low order of printing management.

On the other hand, many have said that the printing industry is over-equipped—meaning that the industry has lacked executives who can sell the full production capacity of their plants; more specifically many have said that the industry is overequipped (a way of saying undersold) from 50 to 150 per cent.

But that percentage of the equipment the farseeing executive will destroy as soon as it is obsolete and unable to properly perform its work. What man would continue to run a 1919 truck, if clear-headed observation would teach him that he could replace it with a 1928 truck at a financial gain to himself and a better service to his customer? This is a serious problem that management alone can solve.

From our analysis of the situation there are five types of men who head the various printing plants, small and large.

The first and most commonly found is the mechanic—the man that has grown up in the industry. He worked up from the bench, he has served as foreman, superintendent, perhaps as estimator. He is the "inside man"—the man who has all details at his finger tips, and yet he still is a mechanic.

The second type, to be found in increasing quantities due to the increased development of advertising printing, is the so-called "super salesman." He knows little and cares less about the mechanical end of the business. He knows enough, however, to talk intelligently and convincingly about his plant and its ability to deliver. He is right in his contention that he can employ men to supervise the mechanical end of the work much better than he can do it himself, and he recognizes that without sales the plant becomes an unnecessary adjunct. He is apt, however, in the majority of cases, to allow his plant to become the servant of his sales organization. This is demoralizing to management and profits.

The third type of man that we find generally in the printing industry is the man who finds himself in the business because his money is in it. He may have bought into the business or may in some other way have been brought into it against his natural inclinations. This type of man is successful or unsuccessful, depending directly upon his ability to organize or have his business organized for him. Our advice to such men is always: hire the best man available to operate this business for you, unless you yourself are thoroughly capable and can show a profit; otherwise sell out and give a chance to someone who has the ability and the desire to make a go of it.

The fourth class or type of printer is the artisan or craftsman, the man who is in the printing business because of a love for the business as a definite objective. Such men are students of their profession and have an object in life. They are primarily organized to serve their customer with no definite desire to make tremendous profits. Because of the service they render and the needs they meet, they usually find a resulting profit. But many fail, because in this class of men are many dreamers and impractical men of artistic temperament who do not see the wisdom of associating with them practical superintendents or clear-headed accountants, the wisdom of engineering.

Fifth: the last and rarest type of printer, but the most successful, is the man who combines all of the good qualities of the above four types of

men with, as well, a recognition of the value of engineering. He recognizes the necessity of securing, at whatever cost, men with the above qualifications to hold important and responsible positions in his organization and thus make up for his own shortcomings. He will be successful in the printing industry or, in fact, in any other industry. The retention and addition of such men to the industry are of prime importance.

The immediate question of any printer will be, how can the present printing plants, having difficulty in making profits, afford to hire such a man? Unfortunately, it is because of such reasoning that many businesses never progress. Without profits we cannot afford to increase our expense, they say, and, unless we increase the expense, we must look forward to a business with diminishing profits. It is far better to suffer the immediate loss, which is inevitable, with a high chance of increasing returns than to face a continued period of diminishing returns.

ENGINEERING, A MEANS TO A MODEL OR STANDARD

Another requirement of the printing industry is the general recognition of engineering and the knowledge of what engineering really is. The most common question which is asked us by buyers of printing, and it is probably more generally asked than any other question, is, "When a bid is submitted by four or five printers, why do the prices submitted vary 100 per cent or more?" This question, although little recognized as such, is a question which must be solved by engineering. We have known of instances where prices have varied as much as 100 per cent even where exactly the same system of costs is used. We all know that the same system of costs is not used in a very large percentage of our plants. The United Typothetae of America report that approximately 25 per cent of the printers in the United States use the same general system of costs, the other 75 per cent vary in cost systems sufficiently for us to state that there are thousands of different ways of figuring costs. Even the 25 per cent that maintain their costs under the U. T. A. system have certain variances because of peculiarities of individual requirements and ideas.

Assuming that four printers use the same cost system, they submit a price on the same job. The first item on the cost blank is the item of paper. The printer is requested to duplicate a certain sample. At the outset, considering that paper amounts to one-third of the job, there is a possibility of immediate variance entirely dependent upon the ability, time afforded, and previous experience in this particular class of paper of a particular individual in a particular printer's plant involved.

The second item of costs on the particular job is composition, and whether we recognize the fact or not, an estimate is in all cases a guess, and a man who guesses on composition is almost always wrong in his analysis of any *particular* job which his plant has not actually handled.

The third item of cost, in most cases the most important, is the cost of the press work. This is a matter that presents to an estimator a considerable difficulty. The job may be ideally suited to certain size presses in certain plants. Those presses may not be available in other plants, and may be available in that plant only at the time the estimate is made, due to a changed condition at the time the job goes to press. Thus the price may be figured on one size presses with an extra allowance to cover the possibility of change.

The printer, on the other hand, may

have automatic feeders or automatic presses which will print the job at higher speed with fewer plates. Here again we find great variance in price. Allowances for lockup and make-ready are apt to vary. The same general variance, sometimes even to a more marked degree, occurs in the bindery. Very few jobs offer anything more than a chance for a guess or estimate good or bad. Unfortunately, few printers have yet recognized the necessity of hiring estimators who are sufficiently capable to be habitually good guessers. The estimator's job can well be claimed as of equal importance with the job of superintendent or sales manager of the plant.

How would engineering help to clear up this situation?

Properly applied, engineering should tell us the best and most satisfactory way of doing any particular job. It should tell us, furthermore, whether the plant with which we are connected is capable of doing a particular job in the most satisfactory manner. It should assist us to determine those particular jobs for which our particular plant is best fitted. It should tell us what equipment we need or do not need in order to suit our plant to the particular requirements of the class of business which is available to us. The opportunity in fact that engineering has of eliminating wasteful effort upon the part of salesmen and estimators, as well as developing a plan and working out simplified and standard methods of overcoming waste, would occupy many volumes; we therefore must pass on to our next point.

THE PRINTER'S PART

The clear recognition on the printer's part of his position in this complicated industrial life of ours is vitally important. The automobile manufacturer understands that his job is to furnish the public with transportation. It was learned long ago that transportation must be standardized. There are very few people in this world that can afford custom-made bodies, not to mention custom-made chassis. It has, therefore, been put to the manufacturer to develop transportation facilities meeting the public's need. The printer's problem is as clear, and that is to convert what in most cases is paper into a printed medium for performing some particular function in our industrial and social life. That medium may be a periodical, a book, a newspaper, a broadside, a calendar, a check, a contract or, in fact, anything requiring paper, ink and type. The printer must not forget, however, that whenever a piece of printing is manufactured it is manufactured for some particular purpose, and if the manufactured article fails to fulfill that purpose that in this way the printer prevents his customer in turn from rendering the expected service to a third person.

There is in the present development of the printing industry a rush to develop tonnage. Little or no recognition is given to the value of this tonnage, and in this connection tons of advertising material are being sent out daily in the mails having little or no appeal and being of little or no value to the industry that is sending it out. Most of us will agree that the printer's hands are tied, and that he is simply the agent of the man who is sending it. This we must know, but we must also recognize that the failure of this literature to perform its purpose will ultimately act as a boomerang on the printer, for future printing from this customer will increase or diminish in direct proportion to the value of his printing and the service it renders him.

This general outpouring of useless literature, if encouraged by printers, is therefore leading him into a doubtful future. How can printers avoid this?

We may well ask, and in answer we say, he must clearly understand the part he plays. He must not develop his printing plant without a recognition of what the future holds for the industry at large. When he comprehends this, he will be a strong advocate of more useful advertising. He will discourage rather than encourage useless expenditures on the part of his customer. He will and must see the necessity and value of advertising advice rendered him and his customer by recognized advertising authorities. Printers can well refer prospective advertising customers to such authorities, for the better advertising agents of this country have developed an advertising philosophy and ability to analyze advertising requirements and situations to a very high degree and are in reality a vital adjunct to the printing industry.

THE RELATION OF COSTS

We discussed somewhat briefly the necessity of a better understanding of costs. We do not mean the necessity of an executive's understanding minute factory costs on a basis of each separate operation, neither do we mean that he is to continue figuring his costs on some fictitious basis of past experiences, nor upon a hypothetical condition that may never be expected to exist. A misconception of how cheap he can figure a job on any such basis is likely to eliminate him as a factor in the printing industry in a very short period of time. Costs hourly and otherwise must be based upon operating methods which could be reasonably expected under proper engineering control. This subject could also occupy volumes. We will, therefore, pass on, limiting ourselves to these remarks.

A NEW SALES POLICY

We cannot overlook the necessity of a sales policy developed as a result of better management, better engineering, a knowledge on the printer's part of his own business and the part it plays in the industrial setup, and a better general understanding of costs and their relation to profits. At the present time, a very large majority of all printing plants are operated as "job" plants, and, in a very large majority of job plants, the factory is subservient to the sales manager; therefore, to the whims of the customer. As long as this condition continues to exist, profits in the printing industry are going to depend very largely upon "super salesmanship," so called. How long do you think an automobile factory or some similar business could continue to make profits should it have to arrange its production schedule on the whims of the buying public? How long could they continue to make a car at a price if they were to stop the output of the groups of cars a dozen or more times to hear the decision of the customer as to just what sort of gears he had decided to install in a particular group in question? How long could they continue to produce a satisfactory article if they were obliged, at every turn, to hold up production, to sit and wait for the return from New York or the golf links, of some man endowed with the power of deciding whether or not the wheel base should be extended or contracted? In other words, how long could the industry exist if the salesman or sales manager, in order to sell the output of the factory, disregarded all principles of good management and good engineering? And yet that is exactly the manner in which the great majority of the plants in the printing industry are operated. Successful printing plants of the future must operate on the basis of good management and engineering. It must be predetermined by the operating head of the plant just what business can be taken, when, and at what

price it can show a satisfactory return. The sales organization must bend its efforts to produce business in accordance with the predetermined schedule. Who receives the benefit? The answer is the same as in the automobile industry—the customer. He will receive a better article because it is better planned, better engineered and more properly manufactured, and it will be at a very materially reduced price.

THE PRINCIPLE OF SERVICE

Perhaps the most outstanding requirement of the industry is "service" on the part of the printer. Founded on an understanding and adoption of the first five principles, it is developed to meet the requirements of the customer. By service we do not mean something unusual: unreasonable delivery schedules, the ability to untangle indefinite specifications, or a lot of costly and unnecessary personal service, but rather a service which is based upon the customer's point of view. Such service requires a definite understanding of the customer's problem and a printing plant organized for the principal purpose of rendering the kind of service desired by the customer; better still, the development of an organization primarily keyed up to *serve* the customer rather than for the particular purpose of *making profits*. It is a well-known fact that street car companies who have understood that their principal requirement was to serve the public and furnish adequate transportation, even though it be necessary for them to add busses and other modern adjuncts to their ordinary equipment, have found it a paying proposition; whereas street car companies organized for profit with the general attitude of the "public be damned" have generally failed. To no small degree it has been the attitude of the public toward the company which has ultimately determined success or failure. So it is in printing—if the customer is encouraged not simply to feel but absolutely to know that the printer is organized primarily for his benefit, and if the printer has proven this time and time again by the service he renders, the attitude of the customer toward the printer is one of wanting the printer to make a profit. Without this profit he recognizes that the printer, an asset to his own business, cannot succeed. On the other hand, the printer who organizes himself primarily for profit and gives such service as he is forced to give ultimately fails in one or more directions and thus loses the confidence and the account of the customer in question. It therefore is our firm belief that printers or any other set of business men who are meeting in groups, or who are developing a philosophy towards their business and its future, should come to a recognition that service is the demand of the future, and that in developing the ability to render a service they are automatically assuring their future profit.

The last and by no means the least requirement is the necessity of a common recognition, understanding and adoption of standardization. The printing industry as a whole has adopted standards that have come through natural causes. These standards include standard equipment, standards of type faces, type height, standard sizes and weights of paper, a standard cost system, standard hourly selling rates, and, in outstanding plants, standard production schedules, standard rates of pay, standard sizes on delivered jobs, standards in number of pages on booklet work, etc. Unfortunately these standards in the main are not industrial standards which are set by authority, nor do they act as a model in the art of printing and typography, for actually the standard of

quality and the standard of typography, the chief measure of printing, are little understood and thus cannot be observed. Unfortunately, many printers have attempted to develop business along individual lines. For instance, there are thousands of type faces used, whereas authorities tell us there are only twenty good type faces for all classes of printing. Hundreds of papers with apparently different characteristics—all in relatively few classes—peculiar sizes, impractical, expensive processes—all of these advanced for the sole purpose of exploitation or personal profit, all making way for standardization.

Weighing and developing on a scale of standards offers something better.

We know, of course, that there are various standards of living, and the more we learn of standards of living the more apt we are to progress. There are various standards of quality in printing, and a like manner of observation would tell us that the more we know of standards of quality the higher our standard is likely to become. Unfortunately, many men engaged in our profession have attempted to standardize to the extent of eliminating individuality, originality, progress and improvement. Standardization of this type becomes a stumbling block, if it does not entirely stop all progress. For this reason many do not realize that every improvement in the mechanics or standards of quality should be on the basis of correct engineering.

And so we find from Europe's medieval population of five million, existing in a squalid setting with no towns, no intercourse, no anything—we have advanced to a population of hundreds of millions—a complex social structure with its existence, maintenance, and pleasure dependent upon the reproduction of words by use of paper, type and ink.

Generally speaking, from a craft for the amusement and knowledge of a few, printing has grown into a great industry in which there are many wonderful institutions operating on production schedules and under able management.

In looking into the future we are encouraged to believe that we are to have a higher order of executives, that printing will be sold to accounts rather than as jobs, that profits will be reinvested and thus capital increased, that engineering and standards will become increasingly more important; for today in this industry we find many wonderful institutions operating on production schedules and under able management, and showing not only satisfactory profits but rendering a service to civilization and helping to develop the printer of the future. Of these concerns the majority are specializing in some one or more classes of printing which they have found themselves able to do as well or better than any of their competitors and thus have been able largely to control their own destinies. There is a second class of printers who have shown themselves as pioneers in the development of new equipment and new means and methods of handling the usual run of commercial printing. Other printers have stood out for quality; still others, through the development of definite factory practices and a philosophy of high production requirements, have shown marked success in this field. But unfortunately these firms are a very small minority of the firms representing the printing industry. They must serve as our models for the future and inspire us to believe in the future of printing. In closing let us again sound a warning note—success in this industry, as in all others, depends upon Progress and Progress upon well-organized thought and work; that is, management, engineering, service and standards constantly improved.

Standardization in the Textile Industry

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THE textile industry should be well served by the aims of standardization. The purpose of standardization is to effect in a plant or industry, uniform adoption of the most economical and useful materials, machinery, equipment, processes, methods, and practices of production and distribution, and to maintain definite and suitable quality of products consistent with the economies and uses desired. The textile industry is so large as to warrant very extensive standardization. It is a prominent industry in any manufacturing country. Among manufacturing and mechanical industries in the United States, the Census of Manufactures ranks textiles in the highest place with reference to the number of persons employed. The materials, types of machinery, and products are common to all civilized countries, so one would naturally presume that standardization has been carried on very extensively in all phases of the industry; but for various reasons it has not been carried very far. This paper, however, will present some of the advances that have been made or are being made.

Standardization of Materials and Products

Cotton

Trade in cotton has been helped much by standardization. The development of cotton standards has been progressing slowly over a long period of years. Fifteen hundred years before Christ, the Rig Veda hymns of India sang of the garments woven of fine cotton. The current volume of world trade in raw cotton alone amounts to about one and one-half billion dollars annually, and is so large that it demands a fairly satisfactory degree of standardization in terminology and in methods of testing cotton.

The way in which cotton standards are used by the trade is of interest. Cotton is sold by weight, and the price varies according to the grade of it. In specific price quotations figures are given which tell the average length of the fibres, or staple. The staple of cotton grown in the United States may vary from three-fourths to one and three-fourths inches long. Further description of the cotton tells its grade as to amount of dirt, of particles of seed or other extraneous matter, of gin-cut fibres, the strength, and the color. Further detailed description is given regarding each of these qualities, as, for example, the color gradations are white, tinged and stained. Price quotations in the United States are stated for cotton of a certain grade known as Middling Upland.

There are varieties of cotton just as there are varieties of apples. The characteristics of the varieties differ not only in staple length and other matters mentioned above, but also in pliability, fineness, elasticity, and harshness of the fibres. The usual characteristics of any certain variety of cotton may be altered by the soil on which the cotton grows, or the kind of weather during the growing season. It was a disappointing experience when the famous Egyptian cotton transplanted to the United States would not produce the same cotton as it does in its own native soil and climate. Universities, experimental farms, governmental agencies,

agricultural organizations, dealers, and individual farmers are all striving to attain better and purer breeding of cotton seed.

In spite of complicated variations, cotton may be so well graded and classified that a buyer can find a common terminology with which to describe definitely his specifications for its purchase. English cotton manufacturers no longer send buyers to America as they did in early days, but now rely upon standard descriptions; and millions of pounds of cotton are sold each year on the basis of these standard descriptions with no inspection by the buyer until delivery.

Wool

Trade in other textile fibres or raw materials has also benefited by standardization. Wool while still in the fleeces as clipped from the sheep is dirty, oily, and has a large content of burrs, pieces of leaves or little sticks; in this condition it is called wool in the grease. How standardization has improved a process may be noted in the cleaning of wool. The burrs are removed by heating the wool to a certain point which is hot enough to char the burrs but which will not injure the wool. The charred burrs are then crushed and readily beaten and blown out of the wool. Without standardized heat control, this process would be difficult, as a lowering of the heat would not char the burrs, whereas increased heat would damage the wool. After it has been cleaned and washed, it is called scoured wool. It is classified as to whether it is fine, half-blood, three-eighths, or quarter-blood. These and other standard terms identify the characteristics of fleeces or parts of fleeces.

Silk

The sampling, testing and grading of silk is very strict because of its price, which is $5.50 per pound for the best quality of raw silk. Regular market quotations in this country for either silk or rayon are for yarn only. Rayon is a synthetic, manufactured yarn and so lends itself to uniformity. There are only about ten companies in the United States manufacturing rayon on a commercial scale, and seven of these make a product which is chemically the same, namely, viscose rayon.

Yarns

Definite practices have been established regarding the various textile yarns. The *count* of either cotton, worsted, or merino yarn refers to its size. Cotton yarn of count 1 is that size of which it will require 840 yards to weigh one pound; count 10 requires 8400 yards per pound and is one-tenth as coarse as count 1. For either worsted or merino yarn count 1 requires 560 yards per pound. The size of wool yarn is designated by *cut* or *run*. The term *denier* is used in telling the size of either silk or rayon yarn. The denier of a yarn is the weight in grams of 9000 meters, and there would be 4,464,528 yards of yarn in No. 1 denier. As the denier figure increases the size of the yarn becomes coarser, but as the count figure increases its size becomes finer. Spun yarns, such as cotton, worsted or linen, as distinguished from filament yarns such as silk and rayon, are first spun and twisted into single threads or strands. These strands may later be combined in any number to form folded or plied yarns. A term 10/2 means that the count of each strand is 10 and that the yarn is two-ply. Another standard feature in the description of yarn is a statement telling the twists per inch and the direction of the twist. There are standard tests of strength and elasticity of yarns. Regularity or evenness of the yarn is a matter of comparison, there being no norm or

scale for this quality. No precise numerical description of yarn is used with reference to freedom from irregularities as single knots, slubs, or particles of seeds; but a standard method of examination has been developing and the descriptions are becoming more and more precise.

A feature of great significance regarding yarn is the amount of moisture which it contains. Most textile yarns are hygroscopic, so it is possible to load them heavily with moisture. Under such circumstances a purchaser may pay dearly for the water in the yarn, and he might incur a risk of yarn being affected with mildew, and a risk that the yarn packages in drying out would become soft and unsuitable for the intended processes. On the other hand, the yarn may be so dry as to be weakened, and then it requires conditioning before it is ready to be used. The proper amount of moisture improves the running quality of yarn. The amount of moisture which is found to be in the yarn by test may be stated in either of two percentages: *Moisture content* is the ratio of the weight of moisture to the total weight; *moisture regain* is the ratio of the weight of moisture to the bone-dry weight of the yarn. Custom closely approaching standard trade practice is developing to regulate the amount of moisture in the various kinds of yarn.

Yarn is wound in many different forms of packages depending upon the immediate processes involved. To those not familiar with the textile industry, it may be surprising to know that about two miles of yarn are used in making one square yard of fine cotton cloth. So many hundreds of miles of yarn are processed in a textile mill every day, that winding necessarily is a very prominent part of the textile industry, for such immense quantities of yarn cannot be handled or used advantageously unless the yarn is wound in convenient packages. There are some uniformities in wound packages in spite of such a variety as skeins, rolled warps, spools, bobbins, cops, and cones. Skeined yarn is in hanks, one loop about the hank being one and one-half yards in length, and the total length of the skein is usually 840 yards. For long-chain quilling, an operation of winding simultaneously a large number of bobbins by means of a certain winding frame, warps are usually 6000 yards long and have 378 ends each. Cones for knitting purposes usually weigh about one and one-half pounds each, and are about five inches in diameter across the base and about three inches in diameter at the top. Southern yarn spinners have taken up with the U. S. Department of Commerce the question of standardization of yarn numbers, plies and put-ups for the avowed purpose of eliminating the risk of accumulating unsalable stocks. There are further standard details regarding the forms in which yarn is wound for handling, shipment or processing, but these few items are sufficient to indicate the trend.

Strange as it may seem, standardization is likely to begin with the product and work its way back through the processes and machinery to the raw material. Cotton yarn is the product of the spinning branch of the textile industry, and attempts to get a perfectly even, regular yarn have carried investigation and uniform improvements throughout the manufacture of yarn and to the raw material of which it is composed. But yarn is, on the other hand, the raw material of cloth making.

Efforts to standardize fabrics have resulted in studies and developments all through the manufacture of fabrics. Factors concerned with selling have ever been seeking newer and better fabrics in order to increase sales.

This has set up a trend or force opposing standardization, for it has increased the variety of fabrics, patterns, kinds of yarns, and weights of cloth. Notwithstanding the possible combinations that can be made of a large number of sizes of yarn, combinations of materials, of special processing and of distinct kinds of weaving and knitting, there are many fabrics with constructions and natures so well defined, that they are known in the trade by particular names, *e.g.*, poplin, serge, ratine, gingham, denim, sheeting, cheesecloth, voile, crêpe, and broadcloth.

TEXTILE MACHINERY

The standardization of textile machinery has been advancing steadily. Much like the standardization of automobiles, uniformity is noted in machines of a given make, and the uniformity is in the main body of the machine with quite some latitude of variation in accessories and extra parts. A winding frame, on which to wind bobbins, made by a certain company is likely to be of one or two general descriptions, but variations will be found in the tension devices, in the character of the guides over which the yarn is to run, and in the distance which separates the spool from the bobbin.

A similar illustration may be found in cone winders. A manufacturer is not likely to make more than two regular models, but there may be quite a number of minor attachments from which the customer may choose, the attachments being for the purpose of catching slubs, for tensioning yarn, for guiding the distribution of the yarn over the package, and for changing the shape of the package being wound. The models do not change as frequently as every year, but perhaps every three to five years, depending upon the changing nature of the winding requirements and upon the character and extent of improvements that have been developed by the machinery manufacturers.

A reason for the trend toward standardization, and the great similarity of all winding machinery for any given purpose, is the nature of the manufacturing in which wound packages are used. Weaving and knitting are the key processes in the making of fabrics. The sheer fabrics which are made on either looms or knitting machines in these days will show defects very clearly. It is easier to avoid making defects in a fabric if the yarn used is of a constant size, if it has regularity of strength and elasticity, and also if it is wound in a uniform kind of package with all packages of the same tension. If one package is soft because of low tension in winding, the package will unwind so freely that burls will be caused in weaving, or some similar difficulty may occur in knitting. If the tension is too great, the yarn may break in the operation, or become stretched. Winding machinery manufacturers advertise that their machines make "uniform" packages of "even density."

Demands for standardization, it has been noted, extend back from the key processes to the making of the yarn, and therefore affects the machinery for carding, combing, spinning, warping, and, in fact, all the machinery used in making yarn. The demands extend in the other direction to the machinery for dyeing, printing, and finishing. Mercerizing machinery may serve as an illustration of this group. Caustic soda is the chemical agent which brings about the mercerization, and machinery must be adapted to control the strength and heat of the caustic baths through which the cloth or yarn is to pass. If the tension is not great enough upon the material being mercerized, there will be a great shrinkage in length and a failure to produce a high lustre. If the tension is too great, the

material may be weakened. It is, of course, necessary to remove completely all caustic from the material, and to leave the material in proper condition. Maintenance of careful mechanical controls have assisted much in attaining these results.

PROCESSES AND OPERATIONS

One of the highly skilled processes is that of short-chain beaming. Short-chain beaming is the transferring, in one operation, of a large number of strands of yarn, in various colors, from untwisted, multiple-strand rope or chain form to a loom-beam on which the strands or threads lie widespread, side by side. Men in this craft think that it requires three years for an operator to learn to beam, and then he is not considered a good beamer until he has worked at the craft a number of years longer. In such a highly skilled job, one might think that the art involved would be so great that it could not be reduced or simplified to one of standard practice. However, the job, highly skilled as it is, lends itself to standardization in certain very important respects.

The standardization of short-chain beaming begins, of course, with the materials to be beamed and with the equipment. The size of the beams on which the yarn is wound is selected for the kinds of yarn beamed, the number of ends per inch (in width of the cloth), the width of the fabric to be woven, and the length of the warp to be beamed. The tension drums are made uniform for all work of a given type, and the speed of the machine is regulated by the foreman so as to conform to specified practice. The kind of reed or beamer's wraithe is also specified for the type of work. Such details were formerly left more or less to the opinion of the beamer, and the result was a different kind of beaming job from each beamer. Even the same beamer would turn out different qualities of work, depending upon what kind of beams or other pieces of equipment happened to be handy when he started the job. A further refinement is the specification in standard instructions regarding the way in which the yarn is to be arranged by the beamer in order to form the proper patterns.

PERSONNEL

Better placement of employees is a usual result of standardization of machinery, materials, products, processes and operations. It is found that short persons cannot reach over the large looms, nor can they reach over the reeds of a large, long-chain quiller frame. A tall person is less adapted to the job of trucking textile material from one department to another, as he must stoop farther to reach the load, and it is therefore somewhat more difficult for him to lift loads to and from the truck. As a result of other manufacturing standardization, employment managers are able to make better assignments to jobs, as it is possible for them to determine better the requirements for each type of work. If improved selection and better placement of employees in this sense is standardization of personnel, then it is a concomitant of other steps in standardization.

As a part of the improved use of personnel, careful studies are made of jobs. Job descriptions and standard procedures are already in effect in quite a number of plants. Cheney Bros., silk manufacturers of South Manchester, Conn., have made very commendable headway in the study of jobs, training methods and learning periods. Similar studies of jobs have been made in the garment factory of the Dutchess Manufacturing Company of Poughkeepsie, N. Y. The

Director of Vocational Education of Parker School District in South Carolina has been in touch with textile companies in that vicinity who are developing standard job practices in weaving and loom-fixing. It would seem that only routine work could be standardized, and yet the work of loom-fixing is being standardized,—a job which has to do largely with repair or adjustment which is mainly exceptional. The Aberfoyle Manufacturing Company of Chester, Pa., has not only been developing standard job specifications for operators but has started the standardization of procedure for foremen.

EXAMPLE OF GENERAL CHANGE

An illustration of how standardization is brought about in materials, machinery, processing and operating, all in one general change may be seen in the developments made in sizing. This operation is putting a starchy mixture on yarn so that the yarn can be more easily handled in subsequent operations. The starch lays the hairy fibres of the yarn so that they do not make so much lint and consequently become tangled and break; it also strengthens the yarn and forms a coating which takes the wear of the operations saving the yarn itself from the chafing which would otherwise result. Once upon a time the sizing department would start out in the morning with a fresh batch of size mixture, made up of a certain number of buckets full of starch and tallow,—and any bucket was a bucket. The boss guessed at how hot the mixture was, and if there was a large amount of work ahead, the mixture was made a little stronger than usual. First white yarn was run through the sizing machine, and it was sized heavily. Later the light colored yarns were run through and finally the dark colored ones, thus avoiding the shading of yarn by any color deposits that might have been squeezed out into the size mixture. The darker colored yarns probably required the heavier sizing, but by the time they reached the sizing machine, the mixture was thinned out, although the boss did his best to replenish or strengthen it occasionally during the day as he found opportunity.

What improvements are made by standardization in sizing? The squeeze rolls are dressed regularly so that uniform squeeze effect is made on the yarn. The ingredients of the mixture are weighed or measured with precision. Each batch is cooked a definite length of time in properly constructed tanks; a chart on the side of the sizing tank or box indicates and records the temperature of the mixture in the sizing machine. An instrument is being perfected to register the viscosity of the size mixture, so that it may be maintained at certain points for all batches of yarn sized during the day. With materials, machinery, equipment, and processing all carefully standardized for each type of yarn, it is a logical and simple step to standardize the operation completely by standard procedure for every man on the sizing job.

The illustration brings to light a characteristic of the standardization movement. In one plant sizing may be standardized in one way, whereas in another plant the same type of sizing may be standardized with machinery, materials and details of methods quite different from those used in the other plant. Thus standardization may be extensive in individual plants and not result in uniformity in the industry as a whole.

DEVELOPMENTS BY ORGANIZATIONS

There are numerous societies and organizations that are encouraging and

assisting standardization in the textile industry. The Division of Simplified Practice of the U. S. Department of Foreign and Domestic Commerce has kept the idea of standardization in the foreground, and it has been instrumental in effecting simplification of certain products. Assistance in studies, experiments, and research on textile problems has been given by the Bureau of Standards which belongs to the same department of the National Government. The American Cotton Growers' Association advocates cotton covering for baled cotton, and standard tare weights for the bale coverings. An organization called the Better Fabrics League functions primarily for the benefit of dyers and cleaners. The Converters' Association is active in discouraging misbranding. The Home Economics Bureau of the U. S. Department of Agriculture is interested in all phases of standardization. The American Society for Testing Materials has a Committee D13 which is assigned to the field of textiles. Elsewhere in this issue there is an article regarding the work of the A. S. T. M., as it is called, but it may be suggestive to mention here a few titles from their 1927 list of standards:

"Identification of Textile Fibers and their Quantitative Determination in Mixed Goods."
"Standard Specifications for Tolerances and Test Methods for Cord Tire Fabrics."
"Standard Specifications for Tolerances and Test Methods for Cotton Yarns, Single and Plied."
"Standard Methods of Testing Woven Textile Fabrics."
"Specifications for Textile Testing Machines."
"Tentative Specifications for Tolerances and Test Methods for Rayon."
"Tentative Specifications for Tolerances and Test Methods for Knit Goods."
"Tentative Methods of Testing Grease Wool and Allied Fibers for Scoured Content."

The *institute* idea has found a receptive attitude in all of the large fields of textiles. The Cotton Textile Institute, directed by Mr. Walker D. Hines, is attempting a comprehensive program which is certain to bring about standard practice in some unsatisfactory trade conditions, and its work will no doubt affect manufacturing. There is a Wool Institute, a Rayon Fabrics Institute, and a Carpet Institute, each of which has a program for its respective field somewhat similar to that which the Cotton Textile Institute has planned in its field. The Associated Knit Underwear Manufacturers of America propose organizing a Knit Underwear Institute which may be a subsidiary to the present organization or supersede it. The Standardization Committee of this latter group of manufacturers presented measurements for five different kinds of garments to the annual convention held in February, four of which were adopted.

There are, of course, quite a number of manufacturers' associations, and from each of them come some practical leads towards standardization. The National Associations of Cotton Manufacturers, when incorporated in 1894 as the "New England Cotton Manufacturers' Association," had its purpose stated in the charter

> for the purpose of encouraging scientific investigation and experiment as to the methods of manufacturing cotton; collecting and imparting information relating to this industry; promoting social intercourse among its members; and establishing and maintaining a library of works on textiles. . . .

Although the name of the organization has changed, the statement of its purpose has not changed; and although it

was organized before the word *standardization* was much used, it has always been disseminating information so that all of its members could bring their manufacturing up to the best practices found. The American Cotton Manufacturers is a similar organization that has drawn its membership from the South, and it sometimes meets with the N. A. C. M.

Such developments are not without their parallels in other countries. Consul General A. T. Haberle of Dresden reports to the Department of Commerce that

> According to recent newspaper reports the principal German manufacturers of rayon contemplate making an agreement regarding the standardization of manufacturing methods and the make-up and packing of this product for the purpose of reducing the cost of manufacturing. A commission has been formed to discuss the problem.

A communication from Consul Hamilton C. Claiborn of Frankfort on the Main, carries the word that

> very intensive work is being carried on in the German laboratories toward improving the quality of the product (rayon), particularly the fine acetate yarn, and producing a thread whose *affinity* for the different dyes may be depended upon as uniform.

One other type of organization may be mentioned as tending to further standardization, namely, integration of industry.

Of the many large textile companies or combinations, one example may be very suggestive. The corporation which is cited,[1] manufactures and sells

> coarse cotton cloths of four classes from the point of view of the consumer. . . . The plants of the corporation consist of . . . two finishing plants (in New England) and five (Southern) cotton mills which spin and weave coarse cloth from raw cotton. . . . The new owner was somewhat attracted by the experiment of introducing scientific management. . . . The principles of scientific management to which reference is made are (1) research, (2) establishment of standards, and (3) control of operations, and are applied all along the line—in determination of policies as well as in merchandising, finance, and production. . . .

One detailed statement from the paper from which these excerpts are taken is typical of the bearing of this combination in the direction of standardization:

> The standardization of these mills with respect to loom construction, conditions of equipment, quality of raw materials, and otherwise, makes possible a functionalization of labor with respect to skill requirements of the different operations. Workers are assigned to operations in accordance with the kinds and degrees of their skill and the kinds and degrees of skill required by the operations; and labor of any particular kind and degree of skill is not utilized on tasks requiring lesser grade.

SUMMARY

In summary, attention is called to these three points:

1. There is a quickened movement toward standardization in the textile industry.

2. The nature and extent of the industry, its materials and processes, call for standardization.

3. Organizations which stimulate investigation and share information, are doing much to hasten and expand the movement. Chief among these are technical societies, governmental agencies, trade associations, the institutes, and industrial integrations.

[1] "Scientific Management in a Textile Business," by Henry P. Kendall, Treasurer of Kendall Mills, Inc., in Bulletin of the Taylor Society, December, 1927.

Standardization in the Music Industries

By Henry C. Lomb, M.A.S.M.E.

Chairman, Standardization Committee, National Association of Musical Instrument and Accessories Manufacturers

VIEWED cursorily, no two enterprises could possibly be more antipodal in their nature than standardization and the music industry. The first reaction of nearly every one connected with the music industry, or with any other art-industry for that matter, to a proposal to apply the principles of standardization to such an industry will be unfavorable; it will be said that standardization and the art-industries are as far apart as the poles and should always remain so. Presumably the music industry feels itself so permeated with the art-spirit that the mere mention of standardization (or of its ally, simplification) is apt to provoke risibility if not disdain. Because the products of the music industry, viz., musical instruments, are the vehicle for one of the highest forms of art-expression, viz., music, it supposedly follows that any influence which savors of mechanistic materialism should at once be anathema. For is not Art, in its very essence, the free expression of an unfettered soul, undefiled by the rules and proscriptions of that pedantic and hamstrung exactitude which Standardization postulates? Of what avail, then, to inquire into a method whose every precept is based on principles that are alien to the fundamental concepts of all art-activities and whose adoption could only bind the industry in chains?

Were this indictment only half true, it would be idle to discuss it. It is, of course, wholly true that the art or the artistry of any nation, particularly that of a free nation, can never reach its highest development if blind restrictions are laid upon it, because freedom of action in art is as prime an essential to its progress as is freedom of speech to the development of a people. In either case, to curtail liberty is to court disaster. But before passing judgment, let us examine briefly the defenses of standardization, seek its real purpose and review some of its accomplishments for the common good.

Defenses of Standardization

The basic idea on which standardization rests is the elimination of economic waste. Few will dispute that the purposeless wastage of materials, be they natural resources or articles fashioned by the hand of man, is in itself unpardonable. When, however, the efforts of a human being are deliberately and willfully thrown away, the wastage becomes reprehensible. The most precious thing in the world is life itself, and to permit or even to tolerate a useless human activity during the brief span of life that is alloted us, is well-nigh a crime against humanity. Whatever philosophic interpretation we may choose to put upon the usefulness or the uselessness of any given activity, there can be no gainsaying the fact that no one would actually benefit, for instance, from the exertions of a group of workers engaged year in and year out in producing one hundred varieties of ten-penny nails when ten varieties would amply suffice for all reasonable demands, and when, moreover, other employment at least as gainful for the workers could readily be found. What constructive purpose was served when, as is authentically reported, a single firm made

7500 different varieties of bed casters, or when three ax manufacturers were making axes in 34 types, 4 grades, 35 brands, 11 finishes, 19 sizes, a total of 6118 variations? The potential savings to ax-using communities through the elimination of unnecessary varieties of axes are so transparently self-evident that the question carries its own answer.

PURPOSE OF STANDARDIZATION

The elimination of superfluous varieties and of harmful or useless qualities of the products of an industry is ordinarily the first step in standardizing and follows in regular course from the systematic survey of the whole field of that industry, which is a necessary preliminary in every case. In such a survey, the interests of the ultimate user or consumer, no less than that of the maker and the seller must, however, be conscientiously consulted; for the astutest business practice of today acknowledges that the old adage of *caveat emptor* (let the buyer beware) has fallen into disrepute. It is commencing to be recognized that the final criterion for the successful merchandising of a given product is its fitness for the use to which the ultimate consumer puts it, in short, its real utility. Such fitness cannot, moreover, be determined on the basis of mere arbitrary opinion, even of expert opinion; it must be grounded on facts gleaned from every available source and subjected to a searching analysis with due regard also to related industries.

In these exhaustive experimental researches and in the coördination of the assembled facts with the needs and conditions of the moment, the scientist and the engineer will be the indispensable guiding spirits. Accustomed as they are to impersonal and purely objective methods of investigation, they will not be led astray by fantastic claims, but will base their findings on verifiable facts alone. Always will they seek to retain and hold fast to that which is good, but not content with what they find on view, they will strive to simplify, to improve the product and to search out new roads through regions hitherto staked off as forbidden territory. And they will not rest, even though the problem is satisfactorily solved for the time being, but will ever be on the alert to re-simplify and to re-improve, exemplifying thus the best traditions of science and of engineering, that their protégé, standardization, is not a fixed, immutable thing, but must itself pass through the same stages of development as do the objects upon which it operates.

Briefly summarized, then, the standardizing process involves first, the reduction of types, sizes and varieties of a commercial article to a minimum; secondly, the adaptation, out of this minimum, of these variations to the greatest possible serviceability and, finally, the establishing of specifications which precisely define the properties or performance of the article, so that it may be measurably reproduced at will and subjected to definite tests upon completion. Refraining from further detail, we will only state that the accomplishments of standardization as instanced in a single industry, the automobile industry, are typified by a saving of millions annually.

ERADICATION OF VARIETY

There are two points in this program of the standardizationalist that the art-industrialist will at once seize upon. The first is the eradication of variety, and the second, the criterion of utility. He will say that individuality, the great summum bonum of art, would be completely extirpated at once by suppressing variety, and that the aspect of civilization would be reduced to a single

level of drab mediocrity. And as to the utility of an object, it is a cardinal principle of art that it must concern itself only with the pleasure and exaltation which its creations bring, than which there can be none more deep or lasting. In the contemplation of a great painting by an old master, or an overpowering symphony of an immortal composer, generations have found a solace and a delight that is as independent of personal profit as well can be. Standardization implies, says the individualist, that machine-made copies produced by the million can equal the original, when even the copy of a Rembrandt made by the master himself might conceivably fall short of the original. Individuality inheres to a single product of genius and to that alone.

INDIVIDUALITY

These points are well taken, but they are somewhat beside the mark. Individuality is indeed as indispensable in art as is individualism in our body politic, Marxian theory to the contrary notwithstanding. Along with liberty, we of America cherish individualism, that is the upholding of the rights of the individual, as our sweetest heritage. We must not, however, confound the purpose of art, or to be more precise, of the fine arts, with the purpose of the industrial arts. The products of the art-industries are primarily intended to serve some definite use and the element of beauty is superimposed upon an article of commerce in order to add to the sense of pleasure which it kindles. So common a piece as a chair should be designed firstly for comfort, strength and durability, and may then be embellished by the craftsman to his heart's content, within the confines of good taste. In so doing, he need not burden his brain, however, with the selection of the standardized nails or glue that may have been used in its make-up, so long as they help to efficiently support the structure carrying his handiwork. Other things being equal, the piano-maker need have no concern as to the color of the felt of his hammers, the comparatively slight variations in different types of bridge-pins or in the size of the case. He will exhibit his skill in the tonal qualities of the instrument, in the artistry of the case and the general beauty of the design. These factors will really be enhanced through their attention-compelling presence upon a uniform "standardized" background.

Again, consider the archetype of individuality, the human form divine. What could be more thoroughly standardized than our own bodies? In our framework, our muscles, our internal organs, and in the functioning of all of these, we are the acme of standardization. In a physical sense, we are all cast, as it were, in the same mould. Otherwise the science of surgery, and to a lesser degree, perhaps, the practice of medicine also, could never have arisen, and every enforced excursion to the operating table or to a sick bed might well be a call to the valley of the shadow of death. Our individualities have not suffered from this standardization. A man's double is so rare as to cause comment; a mother can always differentiate between her baby-twins; the adroitest criminal, subjected to the proper tests, cannot long hide his real identity. Personality is expressed by the lilting step, the open countenance, the warm handclasp, the flashing eye, the sonorous voice and not at all by the slightly varying relative positions of two hearts even though they beat as one. As pointed out by Whitney,[1] standardization, far from cramping in-

[1] Whitney, A. W., "The Place of Standardization in Modern Life." Inter-American High Commission, Washington, 1924.

dividual initiative, is really "the liberator that relegates solved problems to the field of routine" and gives genius free rein for the creative work it alone can do.

ACCOMPLISHMENTS OF STANDARDIZATION

As intimated above, the final question whether standardization, wisely administered, will redound to the benefit of applied art and to the music and other industries dependent thereon, can perhaps best be found by inquiring into the public ends that these industries seek to serve. Are these ends not satisfied when the greatest possible impetus has been given to art-appreciation, a result dependent upon and attended with the widest possible distribution of art-products? Truly has it been said "that music was intended by Divine Providence for all the people and is of benefit to everyone." [2] With similar force, this applies to the other fine arts also. Man does not live by bread alone. And while the problem of daily sustenance and shelter will doubtless be uppermost in the minds of millions for years to come, the rising standards of living will bring opportunities for culture to increasingly larger numbers of our people.

If standardization can help to make available to these potential music-lovers and art-lovers the pleasures and the benefits to be derived from the cultivation of music and art, then the industries in question owe it to themselves and to their public to embrace its teachings and profit by its lessons, as so many other industries have already done. In this manner they will aid in the ultimate purpose of civilization of deflecting the thoughts of the masses from the mean, the sordid and the vile to the good, the true and the beautiful, and will so add to the sum total of human happiness.

The music industry has already registered its approval of the fundamental principles of standardization by the adoption of the standard pitch for musical instruments and with proper direction will no doubt extend the application of these principles. Let the industry never forget that through its instruments, it disposes over one of the great constructive forces of the world, music. It is needless to dwell here at length upon the importance and value of music in moulding the lives and the conduct of men, for we are all touched by it. Although playing primarily upon the emotions, music nevertheless exercises through them a powerful influence upon the mind and upon the sway of the imagination, the mainspring of all original creative effort. In thus disseminating music, therefore, the music industry will render a great service to education and human welfare.

A distinguished telephone engineer has recently said that he envisages the time when a vast network of intercommunication between all nations will make necessary the use of a common language that will bind the peoples of the earth together into a single brotherhood. Is it too much to say that, in a sense, this common language already exists in music? A universal language based on musical sounds is not impossible, for the appeal of music is universal and it is understood by every human creature. What wonders could not be wrought if the activities of mankind were attuned in unison to the divine harmonies of music? The internecine quarrels, the misunderstandings, the hatreds that have scourged mankind through the ages would be forever banished and the peace and contentment, not of false Utopias, but of a practical and workable idealism, would take their place. In contributing to

[2] C. M. Tremaine, "Enriching Human Life through Music." New York, 1926.

this great cause by fostering music in the way it readily can, the music industry would make its own unique contribution to the progress of the world. With such a mission before its eyes, how can it, how dare it fail?

Standardization holds out its hand in service, not for mastery.

Standardization in the Filing Equipment Industry

By John L. Stephens
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FROM the East Indian, Gandhi, comes the warning that the smashing of machines and the return to a medieval spinning wheel mode of life is the only salvation open to mankind. A fanciful play, R. U. R., a few years ago was commented upon widely by many individuals who are interested in our economic and social progress. Dr. Glenn Frank of the University of Wisconsin recently wrote a series of three articles on our so-called machine civilization and these were published in a widely circulated business magazine. A German motion picture, "Metropolis," has attracted considerable popular interest. Dr. Samuel Stratton of the Massachusetts Institute of Technology went so far as to entitle an article "Robots," which appeared last fall in a large national weekly,—this title coming directly from the imaginative play mentioned before, and referring to the man-made, man-like automatons which performed the physical tasks of men.

To a degree there is a popular interest in this age of the machine. More than that, economists and the more important business men are interested in it. What the future holds is ever the subject of speculation, and the future is concerned more with this order called the "machine age" than with any other condition. It is not too much to say that war and peace, political reformations, laws, art, social customs and even some aspects of organized religion are all merely functions of this tremendous affair,—not the all-important considerations that some or all of these have been at one time or another in the past.

It is generally accepted, then, that the machine is the most significant outgrowth of modern civilization—or—modern civilization is the outgrowth of the astounding changes the machine has made. Take your choice.

Now, it is true that records and writings and figures are what might be called the nervous system of the machine-organization, the present-day large scale production and distribution organization. The utility of a machine is greatly reduced or destroyed entirely if its owner does not know whether it should be working or not, or how often it should work. The only way an owner can decide is by the information that comes to him in the form of records. Records of sales, written suggestions of distributors, records of wages, records of transportation agencies, records of credit, reports from the suppliers of raw materials,—all these decide the reason-for-being of the machine. Conversely, perhaps the machine was the original reason-for-being for the chain of information, but it subsists, or produces, only in proportion as the written records indicate it should produce.

Henry P. Dutton of the Northwestern University School of Commerce discusses this in this manner:

> In a certain great manufacturing company there are twenty or more large factories and the selling agencies encircle the globe. In matters of detail the producing units are autonomous but the central executive organization, through its staff services, works out the policies and standards used by the local unit. The plan of organization is typical. . . . The advantages of the large unit in business were clearly recog-

nized in the nineties and many attempts were made to secure these advantages by consolidation. The results were frequently disappointing. Various reasons explain the earlier failures, but unquestionably one explanation lies in the fact that the tools and systems of record and communication then in use were inadequate to the needs and demands of the large business unit. . . . In a small company the proprietor himself handles many of its affairs and has a first-hand contact with the rest. Such intimate contact becomes impossible as details multiply. Its place must be taken by an organized information system that will supply information that is not only timely, but abundant and accurate as well.

Mr. Dutton then shows how business record systems and business machines have helped make the large complex business unit practical. He says:

More thought is being given to the design of the system as a whole, to the end that when a fact is recorded or a transaction initiated, all subsequent uses of the fact or sequels of the transaction may be foreseen and provided for. . . . The connection between the application of machine methods to office and record work and the increase of the possible effective size of the organization unit, is apparent.

STANDARDS IN RECORD-KEEPING EQUIPMENT

Therefore, it is obvious why it is possible for the filing equipment industry to take itself seriously. Machines make modern business, ideas make machines, and ideas feed on information, which *because of its multiplicity and variety must be kept in order, available, accessible, useful.*

It is with the standardization of record-keeping equipment that this article is concerned.

The first thing to do is to find out briefly how filing equipment developed up until the time that the first move was made toward standardization. This does not require a detailed historical account, and it suffices to say that the systematic filing of letters, bills, cards and other records did not amount to much in any line excepting library practice until the beginning of this century. Before this nearly every place of business or establishment where records were filed used a system peculiar to its own demands. The sizes of records varied widely. One of the first card filing systems employed playing cards. This was devised by an abbé who cataloged the Bibliotheque Nationale in Paris in the latter part of the eighteenth century. About the only established sizes were for lawyers' use, the legal or foolscap size, and the document size, both of which are used today. The natural result of this diversity of record sizes was that every business house that considered itself large enough to have a filing system ordered specially made equipment from the manufacturers. These manufacturers, however, speedily realized that demand alone does not determine what is bought, and began to sell indexing specialties of various kinds. It was around 1900 when manufacturers, who had been filling special orders, brought out small units which stacked horizontally for more or less recognized records. These were the first stock filing units, and they did not meet with much public acceptance.

Individual selling points, construction features and peculiar advantages were emphasized by the different manufacturers and there was practically no attempt at standardization, except the natural conformation to the record sizes demanded by the customer.

The work of Melville Dewey and H. E. Davidson during the last fifteen or twenty years of the past century must not be forgotten, however. These men were responsible more than anyone else for the first application of card systems to business. At first Dewey had

paid particular attention to the indexing of libraries and scientific institutions, and many installations of this nature were made. Much of this work was done in and around Boston. Dewey was a strong advocate of the metric system in card record measurements and did much toward standardizing on that basis, but today, in spite of strong Government endorsement, the only metric cards in use are nearly always found in libraries or scientific institutions. Standard sizes now are in inches: 3 x 5, 4 x 6, 5 x 8, 8 x 5, and so forth.

But to get back to cases, the general acceptance of present filing methods came after the beginning of this century, and a National Association of Steel Furniture Manufacturers was formed March 27, 1915. This is now composed of thirteen members. Four other manufacturers coöperate with the Association. Headquarters are at Cleveland, where the secretary, J. D. M. Phillips, is located.

There are more than fifty manufacturers who make filing equipment. Considerably less than half of these belong to the Association. Of the members of the Association, about five can be classed as major manufacturers.

Before going any further it is advisable now to show just how the *products of these companies vary*. The following table should be noted carefully, because it is a picture of the *present condition* in the filing equipment field. It shows the variety of measurements in a case designed to accommodate letter size papers,—a letter file with four drawers, one on top of the other, all in one upright case. This is the bread-and-butter item in every manufacturer's line, and the table shows the differences in the cases of the five major manufacturers.

WHY STANDARDIZATION

One manufacturer, accepting membership in the newly formed association, wrote: "The standardization of metal gauges, finish, size of drawers and particularly the uniformity and clarity of architects' specifications are some of the problems for your early attention."

Now, there are two chief designs in all steel filing equipment:

1. Verticals or Uprights (such as that described in the table above).
2. Horizontals (which have the same construction principles, but have the drawers *side* by *side* in the unit, instead of one above the other. These horizontal units have intermembering devices which enable the user to stack them up in any combination that suits his purpose. Two widths are usually found in each manufacturers' line. The narrow width accommodates one letter size drawer; the wide width accommodates two. Other size records can

Company	Height of Case	Width of Case	Depth of Case	Filing Capacity in Inches Per Drawer	Filing Capacity in Inches Per Case	Cost Per Filing Inch
A.....	52	14¼	27	25	100	.567*
B.....	51	14 9/16	25¼	23⅝	94½	.603*
C.....	52⅝	13.94	25	22¾	91	.651*
D.....	51 13/16	14.19	24½	22 5/32	88.652	.651*
E.....	50¾	15 1/16	25 1/16	23 3/16	92¾	.636*

*Correct in September, 1927, according to all available information.

also be filed in drawers made for the purpose and built into the unit, but the two widths remain the same, of course. The horizontals of one manufacturer will not in any case interlock with those of another).

Wood filing equipment is practically out of date and is almost entirely supplanted by steel, for obvious reasons. Exactly the same conditions existed in wood as in steel, which came into prominence from ten to fifteen years ago. Wood is not considered in this article.

At any rate, one of the *very first moves made* by the Association was an investigation of standardization.

Before going further, let us note that there are *two* distinct considerations in the standardization of filing equipment. These two considerations are entirely different, and radically different in their effects on the industry.

1. Standardization of finish, gauges of metal, grades of metal,—in other words, minimum specifications as to the properties of the materials that make a filing cabinet.
2. Standardization of all lines as to exterior dimensions and intermembering devices.

Now we will see what the Association first did toward standardization. In the words of the secretary, soon after the Association was formed there was a discussion and submission of samples of mahogany, oak grain and green finishes, with the idea of harmonizing them. Eventually, standards were agreed upon, but when each member analyzed the effect of adding to existing installations and of removing individuality in competition, no action was taken.

As competition increased, the variety in styles became more apparent, so the Association appointed a committee to see what could be done about eliminating superfluous styles. That committee is functioning today and has caused the removal of many items from the lines of the various manufacturers. These removals were made because the items in question did not fill any consumer demand worth considering.

But this progress has been necessarily slow. The public establishes the sizes of the records that must be housed and they claim, in turn, that the paper dimensions are determined by the quantity of space required on each piece of paper to show properly what is written or printed there. There has been no consumers' agreement. At present, there are twenty-four record sizes in common use, some of which vary as little as three square inches.

The failure of the members to do anything about standardizing on finishes is easily justified. It must be remembered that a great deal of each manufacturer's business is "repeat." A large customer standardizes on a certain line. He adds to it from time to time. The first case he bought is exactly the same as the last case he bought. His filing facilities consequently are a unit in every sense of the word. A good filing cabinet will last the life of nearly any business. Tests have been made proving that a really good cabinet will operate for a hundred years without wearing out. Filing cabinets are not scrapped like most other machines. They last for years and years. Why should a customer be forced to accept cabinets of different finish from the ones of the same make that he already has? There would be no justification of that.

This would be almost as impossible as it would be to change over the entire line of record card sizes to the metric measurements. This would probably result in the scrapping of half or more of the manufacturing equipment in use today.

The next movement toward stand-

ardization was really not a movement at all, because it affected only one consumer. It happens that this consumer is the largest in the world. The General Supply Committee of the United States Government has purchased as many as nine thousand pieces of equipment in one year. But the fact remains that this committee does not represent the buying public,—only one large customer.

The Government laid down certain specifications as to intermembering devices and outside dimensions. One manufacturer accepted the Government standards, but other manufacturers have also furnished filing equipment to the Government, and conformed to the standards.

This development is due only a passing notice, because it meant simply a buying on specification by a very large user. It did not make a particle of difference to the buying public.

Now comes the essence of what has actually been done in the way of standardization.

On October 24, 1923, a Sub-Committee on Office Furniture, appointed by the Federal Specifications Board, wrote to the National Association asking for standard specifications. On July 29, 1926, the text of the specifications, as drawn up by the Association, was presented to the Sub-Committee. It had been approved by all except one member.

One of the engineers, who was intimately connected with the project during the time it was in preparation, estimated roughly that more than $50,000 was expended in one way or another by all the representatives who helped draft the finished text. The bulk of this, naturally, represents the valuable time of various company engineers and officials.

These specifications did not limit outside dimensions or interlocking devices. There was no attempt to lay down a rule that all manufacturers should make all their stock units in one size, nor was there any mention of a rule requiring each member to make his goods so they would interlock with those of every other member.

These specifications did, however, set minimum limits below which the materials must not go. Following is a typical extract from the section on "steel horizontal business furniture" dated May 12, 1925. This is part of the submission of July 29, 1926.

I. TYPES AND GRADES

Steel horizontals shall be herein divided into two types, two grades and two classes.

1. Types
   Full horizontals shall comprise Type I, while half horizontals shall constitute Type II.
2. Grades
   All pieces which do not come under the following clauses shall compose the second grade.
3. Classes
   Full and half horizontals shall be deep or shallow, Classes I and II, respectively.

II. MATERIAL AND WORKMANSHIP

1. Material
   Case: Metal furniture grade 1 sheets shall be employed as follows:
   - Finished panel, 20 gauge
   - Finished back, 22 gauge
   - Dividers, 22 gauge
   - Top plate, 22 gauge
   - Base, 20 gauge

   Locker sheets shall be used as follows:
   - Inside panel, 22 gauge

   Black sheets shall be employed as follows:
   - Base of piece, 22 gauge
   - Top plate of piece, 22 gauge
   - Channels, 16 gauge

   Linoleum or other vegetable composition which has been subjected to heat, of recognized commercial quality, shall be used to cover working surfaces. It shall not be less than 0.119 inches high.

This is a sample of the detailed work that went into this exhaustive list of specifications. Note that there is no mention of standardized interlocking devices nor of dimensions that would allow the indiscriminate use of any and

every make in one filing installation. As it stands now a customer, theoretically, continues to use the make he bought when he first established his filing system. He does this to keep his filing equipment coördinated and standardized, within itself, 100 per cent.

The attitude taken toward dimensions in the Association's book of specifications can be found on page 10, Section VII, of the portion devoted to "steel clerical business furniture" (chairs, desks and tables). Here it is: "*Furniture does not intermember, therefore, definite dimensions may be stated.*"

Minimum specifications as to materials, yes; but standard dimensions and universal interlocking devices, absolutely no.

The text has never been adopted by the Sub-Committee, and here the matter rests at this writing, so far as the general knowledge of the Association is concerned.

Surely the situation is not ideal. But what would be an ideal situation? Who is qualified, let us ask, to lay down standards for anything manufactured and used by the public? Where is standardization useful and where is it to be avoided? What right has a maker to make a product his own way? What is it all about, anyway?

It is proposed to show:

1. *What the shortcomings and virtues are of the Standard Steel Furniture Specifications, composed by the National Association, and the reasons for them.*

2. *What the logical result of absolute standardization would be.*

3. *That there is another basis on which specifications can be drawn that is far superior to (1) minimum specifications for materials or (2) the ridiculous idea of making all pieces of equipment exactly alike in dimension, interlocking devices and finish.*

4. *That a very similar field is intensively using this third method of "standardization," if it can be called that, and that it is the only universally satisfactory method, and that it has thoroughly proved itself.*

To begin with, the Specifications written by the Association are the product of the people that make the equipment. However sincere the motives of the Association, it is absurd to think that the various representatives of the member companies would be disloyal to their companies to the extent of recommending a standard for a certain piece of steel that would throw their product below par. Like many specialty fields, the filing equipment business is highly competitive. Long hours of thought have been given to the study of construction problems —better ways to do things—by the various company engineers and their staffs. Why should they contradict themselves? The engineer says, "I am making my case in a certain way. I am not figuring on losing any money for my company by throwing out machinery, buying more or changing my source of supply for raw material, or by buying another grade of raw material. I won't advise changes until I see fit. Therefore, I won't stand for anything that won't let my cabinet into the approved classification." And he's perfectly right.

Therefore, the theoretical cabinet that would be made in accordance with the minimum specifications as to materials would surely not be the best cabinet that each manufacturer could make. It would be a satisfactory cabinet, all right, but would it be a really fine cabinet? However, no such cabinet is made and it is out of the discussion. The point is: the specifications were drawn by interested parties—with the very capable supervision

of the absolutely disinterested officials of the Association, of course—but the fact remains that the Specifications were approved almost unanimously by the Association.

The virtues of the Specifications are genuine and worthy of high admiration. At the very least they represent a ready willingness on the part of an important trade association to try to the utmost any project that conceivably could benefit the buying public, the Government or the Association members. Men trained in the industry since its beginning gave freely of their time and thought to this enterprise, and it represents a sincere attempt to insure the public getting a good filing cabinet from each and every Association member. The Specifications themselves are of value to every member as a catalog of what is suitable for certain purposes, and what is not suitable. It is a complete manual.

STANDARDS OF PERFORMANCE

What would the logical result of absolute standardization be, if this meant:

1. Uniform dimensions, construction and interlocking features for every manufacturer in the field,
2. Exactly the same raw materials used in the manufacture of every file,
3. Identical finish, exterior appearance, drawer capacity, etc.?

Such a theoretical condition is probably described in half a dozen texts on economics and sociology. It is almost unnecessary to go into it here, as the results are obvious. Here are a few of them, as they appear from a practical point of view:

1. Immediate departure of all designing and development engineers for other fields, or for the poorhouse. What would be the use of having them?
2. Immediate stagnation throughout the field, with competition existing only inside the shops, not in the customer's place of business.
3. A frantic effort to cut costs on the part of all manufacturers, with the inevitable labor troubles and other results of corner cutting.
4. An ever increasing disability of the consumer to get equipment to fit new situations.
5. A total lack of pride in his product on the part of every manufacturer.
6. A complete lack of touch with the improvements in raw materials.
7. A very serious eventual hampering of business development because of the lack of proper equipment with which to work.
8. The eventual integration of the industry into one organization,—a condition that is totally against our present economic order, which is truly a product of natural laws.

This is certainly a complete enough indictment of an unsound theory.

Now, there is another kind of standardization that has not been touched upon. In fact, the word that describes it has not yet been used in this article. Up until this point we have talked about materials, about gauges of steels, about finishes,—about uniform dimensions. And there has been an objection, a difficulty arising in connection with every concrete effort made and with every theory put forth.

Let us forget that filing cabinets are made of steel and that they used to be made of wood. Let us forget everything except the fact that filing cabinets are made to file records in. It doesn't make any difference whether the drawers are 24 inches deep or 24 feet, or whether the cabinet is made out of steel or solid gold, or whether the slides are heavy or light, or whether it has any slides. Let us understand that the best possible filing cabinet is the cabinet that helps its user file records in the best possible way.

In other words, let us standardize on *performance*.

If a machine can do what it is supposed to do, is it satisfactory or isn't it?

One of the members of the sales force of the industrial division of the Continental Motors Corporation recently made the statement that "the length of a man's legs does not have to be regulated. It is necessary only that they reach the ground." The implication is obvious.

The question immediately arises: Who can lay down the "standards" of performance? What body is capable of saying whether a filing cabinet properly accomplishes its purpose?

We have already seen, surely, that the body would have to be disinterested absolutely. We have also seen that it must be scientifically capable.

Now it happens that the making and selling of fire protective safes is an important part of the filing equipment industry. It is perfectly natural that a manufacturer who makes "machines" to file records in, is also interested in "machines" to *protect* records in, against fire, molestation and theft. Every major manufacturer in the field sells safes for the protection of records of all kinds and also sells the interior equipment in which the contents of the safe are filed. Here is a job for standardization indeed! The destruction of valuable records by fire runs into millions every year. How can the customer know that he is getting the particular safe that will suit his purpose best? How can he procure—after he has found out what kind of a fire risk he has—the kind or grade of safe that will meet that fire risk successfully?

In Chicago is a scientific institution maintained by the National Board of Fire Underwriters and known simply as Underwriters' Laboratories, Inc. Let us quote from a book, "The Truth about Testing Safes."

> This institution (Underwriters' Laboratories) occupies a peculiar place. Utterly impersonal, completely non-commercial and as impartial as the weather, it pays no dividends, makes no profits and devotes all its energies to one undeviating purpose,—the ascertainment of fact. In doing this it has built up an extraordinary plant and has assembled a large force of technical engineers. The nature of its work is summed up in an extract from an official statement, as follows:
>
> > Underwriters' Laboratories, Inc., was established and is maintained by the National Board of Fire Underwriters for service, not profit.
> >
> > The object of Underwriters' Laboratories is to bring to the user the best obtainable opinion on the merits of appliances, devices, machines and material with respect to life, fire and collision hazards, and theft and accident prevention.
> >
> > The work is undertaken as one means of reducing the enormous and disproportionate loss of life and property by fire and accident.
>
> It is unusual to find a non-commercial institution operating in a commercial world as a direct offshoot of a great business interest. Yet the reason is simple enough: the insurance companies require accurate knowledge of all elements of hazard if their underwritings are to be more than mere guesswork and gambling with chance. Such knowledge, therefore, is the foundation for a vast system involving billions of dollars' worth of protection and underlying the entire credit structure of American business. With this incalculable interest at stake, personal opinion and human bias must be eliminated and knowledge must be painstakingly obtained through the highest technical skill and the most complete equipment. . . . In 1915, the Underwriters' Laboratories issued to manufacturers some fifty million labels, but in 1921 it issued approximately five hundred million, and this huge increase was a natural growth during only six years' time, being made virtually without efforts. . . .
>
> Underwriters' Laboratories is not physically confined to the buildings on East Ohio street in Chicago. It has a large laboratory

in New York and many smaller testing stations throughout the country. It has branch offices or agencies in every large city in the United States and Canada, and a connection in London, England.

The remarkable thing about the whole matter is the fact that the above quotations were taken from a book *sponsored by the National Association of Steel Furniture Manufacturers!* Talk about finding diamonds in your own back yard!

The Underwriters' Laboratories test safes by subjecting them to conditions which duplicate actual fire conditions as closely as possible. It is not proposed to go into detail about this. At any rate, safes are placed in furnaces that have mica glazed observation holes in them, and the interior temperature of the furnace is sent up to as high as 2,000° in some cases. Papers are placed within the safe, and thermocouples, inside and outside, register the temperature. While the safe is red hot, it is dropped thirty feet on an uneven rubble of brick. Fire hoses are turned on it—it is subjected to every terrific test that a safe would have to meet in a fire, and then some. If it passes these tests, it is awarded a label. If it doesn't, it isn't.

Three grades of labels are issued. The Laboratories insure that the manufacturer is keeping up the standard because their representatives can go out into the field and take a safe for testing at any time. These representatives also visit manufacturers' shops at any time they wish.

The result is that the customer can get the kind of safe that his fire risk demands.

The Laboratories engineers don't care what a safe is made of (minimum specifications) and they don't care how wide or tall it is (exterior dimensions and interlocking devices). They are interested only in this: Will it protect the records it is supposed to protect? Will it perform?

So here is our answer to what is the best kind of "standardization" for filing equipment.

Instead of going into tortuous detail about minimum specifications, why not let some impartial, impersonal group find out what a filing cabinet will actually do in service?

If the user is going to file heavy material and the drawer is going to be moved in and out at very frequent intervals, it is logical to assume that he will need about the strongest and best filing cabinet made. If the cabinets of all Association members came up to the proper standard of performance, he could rest assured that if he bought a "Grade A" cabinet that it would last. If he wanted a cabinet for inactive or semi-active records, a "Grade C" would probably fill the bill. Let appearance, company reputation, service, indexing methods and knowledge of the problem decide whose cabinet to buy.

After all, the consumer is the person that makes the rules and is the one to be satisfied. He has a way of seeing to it that things he doesn't want and can't use are speedily tossed out of a manufacturer's line. If we want a simplification process, a cutting down of the number of items in a line, let us educate the consumer, for with him lies the decision. He can be persuaded, but he can't be forced, though some advertising "experts" believe to the contrary.

Where would we find a scientific group to test our filing equipment as efficiently and scientifically as the Laboratories test safes? This question should eventually answer itself, because there is surely a need for this in our industry.

Some day the Association will find a way to do it. One group that imme-

diately suggest themselves are the technical colleges of the country. This is merely a hazarded guess, but it is worth investigation. Could not such work be done at Rensselaer, M. I. T., Rose, Carnegie, Pittsburgh, or at any of the engineering schools of the large universities?

Again, this group must be impartial, impersonal, disinterested. It must know the office and filing equipment field thoroughly and be in touch with it constantly, in order to provide for the new situations that are constantly arising. A certain standard of performance, in the filing equipment field, may change overnight with the bringing on the market of some new bookkeeping machine or some new method of filing records. A standard must change, it must be flexible.

The materials that filing equipment is made of will take care of themselves. If some new alloy that allows of easier fabrication is developed, it will be adopted soon enough, and if this new material makes it possible to make better filing cabinets, then the impartial testing group can demand *more* from every grade. And the consumer is taken care of the way he should be.

The consumer is the man that makes decisions that affect the fundamentals of trade. Nobody else does.[1]

[1] I thank J. D. M. Phillips, Secretary of the National Association, and David E. Hunter, Chief Engineer of the Shaw-Walker Company without whose help this article could not have been written.—JOHN L. STEPHENS.

Standard Purchase Specifications in Railroad Operation[1]

By Robert P. Brecht
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THE railroads of the United States spend annually about $3,000,000,000 in the purchase of materials and supplies—a volume of purchases second only to that of the Federal Government. The number of commodities included in this immense purchase order run into the hundreds of thousands, for a railroad's activities ramify into many fields: operations must be extended, new lines developed, old lines improved, tracks, roadbeds and rolling stock kept in the best operating condition, bridges must be built, buildings of various kinds constructed, telegraph lines opened and kept ready for service, water service provided at strategic points—to give only a hurried glimpse of the teeming world included under the category of railroad operations. And all of these activities require supplies and materials of a kind and quality best adapted to the particular need that must be served.

By simplification or standardization of purchase specifications is meant the elimination of unnecessary materials and specifications, and the adoption by all railroads of a uniform specification code. Where the development of these specifications carries beyond the immediate interests of the railroads and is felt in other industrial activities, the attempt is made to secure uniformity of specifications among all interested parties. The possibility of great savings through the elimination of unnecessary duplications and kindred wastes in purchasing has greatly stimulated the movement toward standardization of purchase specifications.

[1] The material presented in this paper is taken from Reports of the Special Committee on Standardization of the American Railway Engineering Association kindly furnished the writer by Mr. W. C. Cushing of the Pennsylvania Railroad. Bulletins Nos. 291 and 300, American Railway Engineering Association.

Tendency Toward Diversity

In coping with its individual purchasing problem each railroad in the past has developed specifications for the materials it has used. In developing these specifications from its sole standpoint duplications were bound to arise as between roads. Identical materials would be purchased under different specifications, and a great variety of materials would be made to serve identical purposes.

Two examples only will be cited to illustrate the tendency toward diversity. In the Directory of Commodity Specifications, prepared in 1925 by the Bureau of Standards in coöperation with the Bureau of Foreign and Domestic Commerce and the American Engineering Standards Committee, there are listed twenty-two specifications for tie plates. The American Railway Engineering Association has specifications covering two distinct grades which should cover all normal demands. Twenty-eight specifications for splice bars are listed in the Directory, five distinct grades of steel specified. The American Society for Testing Materials have specifications for all five grades.

A more careful scrutiny of the cases given above would probably disclose a closer identity of items and specifications than is gathered by a cursory examination of the data. No two groups write

specifications in exactly the same way. Some discounting of the charge of excess material and specifications frequently laid to the railroads must be made, and yet diversities do exist. The railroads acknowledge this fact, and their activity in the direction of simplification is evidence of their desire to improve the situation.

DIFFICULTIES TO SNARE THE UNWARY

The pathway of the reformer is usually beset with difficulties. The protagonists of standard specifications for the railways are no exception to the rule, and while the difficulties surrounding the problem are not insuperable, they are real and must be conjured with. These difficulties may be divided into two classes, (1) those incident to the development of standard practices, and (2) those incident to securing universal adoption of these practices.

Each railroad presents a nexus of individual peculiarities. Operating conditions vary from one road to another and demand differences in specifications of materials. Track appliances and materials must be designed to meet the requirements of varying stresses set up by different densities of traffic and diverse concentration of load application, as transportation agents' roads vary from heavy and fast trunk line carriers to the branch line serving small communities in sparsely settled areas. All of the variations in this sliding scale of importance may be found within the trunk line railroads. Specifications for material and for size and dimensions of appliances must necessarily arise in order that they endure under the varying service conditions.

The problem of purchasing is complicated still more by other considerations: by the Interstate Commerce Commission requirements for an open market, by the inventor and manufacturer of proprietary articles, and by the demands of shippers upon the traffic department of railways for reciprocal business.

All of these difficulties can be resolved but only through slow and deliberate effort and only in coöperation with all parties normally using the commodities.

Then there are the problems that must be faced in securing the adoption by all railways and interested parties of the specifications decided upon. There are a great number of roads that must be corralled and brought into an attitude of acceptance. There is the difficulty of keeping them *sold* upon the value of the recommended practice. And this in turn introduces the added difficulty of keeping the standard up to date. Inertia of habit must be overcome in securing the use of the standard in the first place and the whole process repeated when it is found necessary to introduce the revision. Standardization of specifications, like all standardization in modern industrial society, is a dynamic concept. There is no stopping, no marking time, but continual struggle to the better level of adaptation. This presupposes a permanent organization upon which devolves the task of investigating, developing and revising the standards, and of *selling* the results of its steady efforts to the railways. It demands an enthusiastic leadership to guide, to sustain and to motivate the organization in its constant quest.

Three pertinent questions, then, may be addressed to the present inquiry: (1) What organization carries on the work of promoting standard practices for the railways? (2) How does this organization develop and secure the use of these practices? (3) To what extent are recommended practices actually used by the railroads?

AMERICAN RAILWAY ASSOCIATION

The parent body interested in fostering the development of standard specifications for the railroads is the American Railway Association, composed of the following seven divisions and several special committees:

Division

I. Operating
  - Telephone and Telegraph
  - Committee on Grade Crossing Protection and Trespassing

II. Transportation
III. Traffic
IV. Engineering
  - Construction and Maintenance Section
  - Electrical Section
  - Signal Section

V. Mechanical
VI. Purchases and Stores
VII. Freight Claims

Divisions I, IV, V, and VI are all interested in the development of standard practices, many of the individual members of these four divisions serving on sectional committees of the American Engineering Standards Committee, but the major rôle in the development work has been assigned to the Construction and Maintenance Section of Division IV, Engineering.

The American Railway Engineering Association, representing the organization of Section I of the Engineering Division, carries on its work of promoting standard practices through a Special Committee on Standardization and numerous Standing Committees working under the direction of the Board of Direction of the Association. Results in the form of adopted standards are published in a "Manual of Recommended Practices" and distributed among the railroad membership. It should be noted in passing that this Manual includes recommendations covering all phases of standardization.

Method of Development

The method by which standard specifications are developed and the several parts played by the above groups in developing them and securing their use may be gathered from the following digest of the "Policy of Procedure concerning Recommended Practices."

A Standing Committee shall be continuing sponsor of its own adopted recommended practices embracing the following duties:

(1) An annual review of each manual-incorporated practice with the recommendation for revision when found desirable.

(2) A statistical survey periodically to ascertain the extent of use by the association members of the practice under study.

(3) Selection of an Association-adopted recommended practice as of mutual interest and importance to special industry and technical associations, or as of national scope, recommending to the Board of Direction in the first instance that it be laid before the proper coöperative committee or technical association, and the American Engineering Standards Committee in the second.

The Board of Direction after favorable action upon the recommendation of a sponsor committee shall proceed in the case of Industrial- and Association-Mutual interest to place the proposal before the interested body, and in the case of national interests authorize the Secretary to request the approval and further action of the American Railway Association.

The Special Committee on Standardization shall keep informed of the rules of procedure and general fields of activity of the associations and committees which may be considered to have interests in common with this Association, and shall be kept informed of

the special coördinating recommendations of standing committees in order to act as an advisor to the Board of Direction.

The threefold character of the work of developing standard specifications should be noted: (1) those standards concerned with the railroads exclusively, set up entirely by Standing Committees under the authority of the Board of Direction, (2) those intimately associated with some other technical or industrial activity, developed cooperatively with the parties interested, and (3) those national in scope developed under the aegis of the American Engineering Standards Committee.

Liaison is maintained with the American Engineering Standards Committee by the American Railway Engineering Association as representive of the American Railway Association, although, as it was previously pointed out, members of other divisions of the latter serve on many sectional committees of the American Engineering Standards Committee.

The present Standing Committees of the American Railway Engineering Association are those on Roadways, Ballast, Ties, Rail, Track, Buildings, Wooden Bridges and Trestles, Masonry, Grade Crossing Design, Protection and Elimination, Signals and Interlocking, Records and Accounts, Rules and Organization, Water Service, Yards and Terminals, Iron and Steel Structures, Economics of Railway Location, Wood Preservation, Electricity, Uniform General Contract Forms, Economics of Railway Operation, Economics of Railway Labor, Shops and Locomotive Terminals and Coöperative Relations with Universities. From the foregoing it will be seen how extensive is the work of standardization undertaken by the American Railway Engineering Association.

The attitude of the American Railway Engineering Association toward the work of developing and securing the use of standards is of interest.

"Progress in the elimination of unnecessary specifications, designs and appliances must come through the laborious and painstaking process of education. Active minds working for the good of the service in which they are engaged are evolving new ideas continuously, and the alert questioners examine quickly into their merits. Through merit alone will they survive. Those who are in the same field of activity, therefore, educate each other.

"For this exchange of thoughts and ideas there must be a forum, and that forum is the technical societies, in the membership of which meet on common and equal ground the consumer, the manufacturer, and the interested men of science, the engineer, college professor, the government engineer, the general practitioner and the consulting engineer. In this forum certain principles are evolved and set up as a desirable mark to be attained. Gradually a greater and greater number reach this mark and many accept some of its principles without accepting all. Moreover, the active brain of a gifted member makes it necessary to introduce changes from time to time, which necessarily adds to the appearance of slowness in the march toward improvement. No sooner is approved practice developed and set up than new suggestions require change.

"The forum machinery in which the consumers of railway appliances are participators is:

"(1) The American Railway Association, Division IV—Engineering Section I—Construction and Maintenance.

"(2) The American Society for Testing Materials.

"(3) The American Society of Civil Engineers."

The above expression indicates the thoroughly sound approach to the problem of standardization on the part of the leadership.

SURVEY OF THE EXTENT TO WHICH STANDARD SPECIFICATIONS ARE USED BY THE RAILROADS

In securing the adoption of its recommended practices the American Railway Engineering Association realizes that it is utterly impossible to force its individual members to the use of the standard. The only policy it has been able to pursue is to urge all members to avail themselves of the practices recommended in the Manual. It realizes further that the standard will finally be adopted only when the recommended practice proves its value for the purpose. No member of an association will make use of a recommendation, which as often as not is a compromise, unless its value is so great as to make its use profitable to his company. Thoroughness of work and constant revision are absolutely essential then to the widespread adoption of a standard.

In discussing the extent to which standard specifications have been adopted it will be well to divide the subject into two parts, one dealing with the activities of the American Railway Engineering Association in securing the use of its "Recommended Practices," the other dealing with its activities in the national movement.

Recommended Practices

Insufficient information in the reports to the various Standing Committees makes it difficult to present a quantitative idea of the extent to which standards have been adopted. There will be sufficient data presented, however, to afford a good estimate of the valuable service the Manual performs.

There are found to be three degrees of use for which the standards are available or adaptable for inclusion in the individual specifications:

(1) Adoption verbatim, or nearly so, of the plans, specifications, instructions or rules.

(2) Incorporation of the fundamental or main items of importance in settling upon and maintaining unification of methods.

(3) Acceptance of the general influence of the data, and citations, in order that one's own practice may be in general accord.

The reply of the Missouri Pacific Railroad indicates the high esteem placed upon the work done by the American Railway Engineering Association committees: "Probably 70 percentum of standard plans, specifications and practices are American Railway Engineering Association or close thereto."

Considered under general headings comparable to the work of the Standing Committees, the experience may be summarized as follows:

Roadways

Thirteen or more subjects are treated under this heading. A typical reply to the question of use is that of the Baltimore & Ohio Railroad—"Generally follow recommendations of Manual, in so far as our conditions will permit."

Ballast

Forty-seven testified to the following extent of use and seemingly in the first degree above:

	Roads
(1) Ballast section for gravel	16
(2) Ballast for stone	12
(3) Specifications for stone ballast	17
(4) Specifications for washed gravel ballast	16
(5) Using the ballast test	14

In addition the Illinois Central and Baltimore & Ohio state that they are

making use of the specifications for ballast tools.

Ties

The "Specifications for Cross Ties" and the "Specifications for Switch Ties" became in 1927 a "National Standard" by approval of the American Engineering Standards Committee. Almost universal use may therefore be accepted.

It is probable, too, that the "Specifications for Dating Nails" are accepted by those whose practice it is to make use of them.

The Pennsylvania Railroad states that the "Specifications for Tie Plugs" have been accepted *in toto* as its own.

Rails

Fourteen roads furnished information on this item. Specimens of their experience are listed below.

Rail Sections

The 90 lb. RA-A has been used by the Southern Pacific, Union Pacific, and with base modification by the Santa Fe.

The 100 lb. RE is being used by the Canadian Pacific.

The 110 lb. RE is being used by the Santa Fe, Nashville, Chattanooga & St. Louis.

The 130 lb. RE is being used by the Lackawanna, Baltimore & Ohio, and Southern Pacific.

Rail Specifications

The Nashville, Chattanooga & St. Louis, Pennsylvania, Santa Fe, Rock Island, Burlington, Louisville & Nashville, Lehigh Valley, Reading, and Baltimore & Ohio report the use with some modifications of the rail specifications. It is believed that this is a small proportion of those making use of them.

Specifications for Joint Bars, Heat Treated

These are followed quite closely by the Baltimore & Ohio and Santa Fe, and the Reading without modifications.

Specifications for Track Bolts, Heat Treated

These are followed quite closely by the Baltimore & Ohio and Santa Fe, and by the Nashville, Chattanooga & St. Louis and Reading without change.

Girder Rail Sections and Girder Rail Specifications

Both of these are used by the Pennsylvania Railroad. Several of the railroads replied that while the recommended practices were not adopted by them *in toto*, they were used as the basis for standards, and considered as a general guide for determining the practice where conditions permitted.

Track

Plans and specifications for frogs and switches, especially the manganese work, have been quite generally accepted. In addition the designs for track spikes and track tools are quite widely used. The Baltimore & Ohio, Nashville, Chattanooga & St. Louis, Louisville & Nashville, Reading and Pennsylvania replied to that effect. The Pennsylvania Railroad has adopted the specifications for steel track spikes *in toto*. These specifications have been made a tentative standard of the American Society for Testing Materials.

Buildings

Specifications for railway buildings have been prepared along with skeleton designs for miscellaneous railway buildings including details of roofs and flooring.

The Baltimore & Ohio and Seaboard Airline state that they work along the same lines.

Wooden Bridges and Trestles

"Grading Rules and Classification of Timber and Lumber for Railway Uses" have been prepared in coöperation with other societies and the industry affected.

Masonry

"Specifications for Portland Cement" have been made a "National Standard" by adoption of the American Engineering Standards Committee and coöperating bodies. Many of the "Methods of Test" for aggregates employed in concrete making have become national standards. The Illinois Central, Union Pacific, and the Pennsylvania report their adoption as standard. The Pennsylvania adds that it has adopted the "Specifications for Billet-Steel Reënforcing Bars."

Water Service

The Illinois Central has adopted the "Specifications for Cast Iron Pipe and Special Castings," and the "Specifications for Hydrants and Valves." Specifications for the chemicals for several water softeners have been provided, and also "Specifications for Wooden Water Tanks and Timber Substructures," and "Specifications for Steel Water and Oil Tanks."

Iron and Steel Structures

The Baltimore & Ohio, Rock Island, and Union Pacific use the "General Specifications for Steel Railway Bridges" as a basis for their own. Two other projects recently completed are "General Specifications for Steel Turntables," and "Specifications for Movable Railway Bridges."

Wood Preservation

"Specifications for Creosote Oil" have been generally adopted by the railroads.

From the above brief survey of railroad uses a number of things are apparent. The work of the various Standing Committees of the American Railway Engineering Association has been extremely wide in scope and very thorough. The railroads show a willingness to use the recommended practices as they are educated to the value of the work. These two facts would seem to indicate a continued, steady rate of progress in the development and adoption of standard specifications by the railways in the future.

ACTIVITIES IN THE NATIONAL MOVEMENT

Of the two hundred and thirty-eight projects having official status before the American Engineering Standards Committee in 1927, forty odd comprised studies in which the American Railway Association and the American Railway Engineering Association had a credited representation, officially cooperating in the sectional committee work. The interests of these committees are wider than the development of material specifications. Many of the projects are directed toward the development of safety codes, scientific and engineering abbreviations and symbols, the rating of electrical machinery, the rating of rivers, etc. Perhaps half the work, however, is directly interested in the setting up of specifications for material and appliances.

The American Railway Engineering Association is itself the sponsor for four projects only. These are the General Specifications for Steel Railway Bridges, Specifications for Movable Railway Bridges, Insulated Wires and

Cables (other than telephone and telegraph) and Specifications for Railroad Ties. Of the four the Specifications for Ties have been definitely adopted as National Standard. The remaining projects are still under study. When it is recalled that the expressed attitude of the Association is definitely against carrying anything to the American Engineering Standards Committee unless it is absolutely of national interest, it is readily understood why the Association has not stood sponsor to more projects.

CONCLUSION

The status of standard purchasing specifications in railway operation may be summarized as follows: The American Railway Association working through its member, the American Railway Engineering Association, has established a permanent organization for the development, revision, and promulgation of standard practices, embracing all phases of standardization, an important element of which is the code of specifications covering materials and appliances. The attitude of the American Railway Engineering Association toward the problem of standard practices is fundamentally sound, and the work of its Standing Committees thorough and deliberate. Through its Manual of Recommended Practices it disseminates its findings among the membership and urges their adoption. By membership in the American Engineering Standards Committee it takes an active part in the national movement. The railroads are considering its efforts in an encouraging manner and adopting them as standard practice wherever convinced of their applicability. It requires no gift of prophecy to predict a steady and ever-widening area of usage for the standard material specifications established by the American Railway Engineering Association.

Standardization of Purchase Procedure for the Federal Government

By Major A. H. Erck
Assistant Chief Coördinator of Government Business, Washington, D. C.

YEARS ago when the instrumentalities of the Executive Branch of our Government were few and the field of their administrative power and control was more or less sharply defined, no common endeavors or mutual interests were involved to create a necessity for coördination. There were no administrative emergencies sufficiently pressing to cause the Chief Executive to demand standard procedure on the part of his agencies in the transaction of governmental business.

The various departments operated practically independently of each other within the limits set by Congress and under this system many different methods of handling Government business grew up, together with unnecessary restrictions, and frequently inefficient methods in the procurement of supplies, as well as in other administrative activities. Honest prejudices, obstinate jealousies and the desire of ambitious officials to remain unfettered in the conduct of bureau business all contributed to the maintenance of this system.

At the end of the World War the Government, burdened with an enormous national debt, was confronted with the imperative problem of securing greater efficiency and economy in Federal expenditures in order that the budget might be balanced and that the enormous amount of war surplus which had accumulated might be disposed of to the best interest of the government.

The most superficial examination of the problems confronting the Government in 1921 revealed that savings and general efficiency in the operation of the Government could be gained only through coördination.

The passage of the Budget and Accounting Act of 1921 and the establishment by Executive Order of the Federal service of coördination provided the President for the first time with instrumentalities through which the fiscal problems of the Government could be met and the business activities of the various departments properly coördinated.

Coördinating Agencies Concerned with Procurement

The Federal coördinating agencies concerned with purchases are the General Supply Committee, the Federal Purchasing Board, the Coördinator for Purchase, the Federal Traffic Board, the Federal Specifications Board, the Interdepartmental Board of Contracts and Adjustments, the Interdepartmental Board on Simplified Office Procedure, and the Federal Business Associations organized throughout the country to handle local questions of coördination.

Consolidation of Purchases

A buyer is in the most favorable position to obtain the best prices when he is able to enter the field of production with his requirements consolidated and supported by a reserve stock sufficiently large to reduce hurried purchases to a minimum and yet small enough to be susceptible of frequent turn-over.

The United States Government will be in a position to exert the maximum of its potential buying capacity only when it shall be able to synchronize demands, consolidate requirements, regulate the distribution of reserve stocks, and transfer excess in one quarter to supply shortage in another.

This problem in Government buying is to organize the separate purchasing units in a manner so flexible that the mass effect of their combined buying power may be secured by united and concerted effort without in any degree sacrificing the sensitiveness of a departmental organization to the pressure of the needs of its own department.

Included in the aggregate of all articles purchased by the Federal Government there are some that by reason of their general use may be designated as Federal Property at Large in contradistinction to articles that are primarily departmental in character. For articles of this type, such as surgical absorbent cotton, explosives, chemicals, balloon silk, and so forth, it is possible now so to synchronize estimates of future requirements as to include the total in one statement of needs of the Federal Government as a whole.

Any one of the participants in a joint purchase may act as agent for the group. The agent department, when so authorized in writing, may include the separate requirements of the group in a single advertisement. The award may be made either by the requiring department or by the agent department when authorized to do so. Contracts following award may be made separately for each department or contained in a single instrument signed by a duly authorized representative of each department forming a party to the transaction, for and on behalf of his department, and so drawn as to be binding upon each party thereto for only so much of the contract as involves that department.

Such joint transactions for the purchase of gasoline have been carried on in the city of Boston with economy and to the satisfaction of all participating departments, and steps are now being taken to expand this method of purchase to include other articles wherever economy will result therefrom and satisfactory deliveries can be made thereunder.

Coöperative purchase by actual collaboration in advertising, awarding of contracts, and storage of material is approved as sound in principle.

UNIFORMITY IN GOVERNMENT PURCHASING

Uniform methods of purchasing bituminous coal are being placed in operation. Departments owning but few automobiles are now able to obtain the trade discount allowed on repair parts, in consideration of the large number of automobiles owned by the entire Government.

Prospective bidders can, by application to a central contact office, be included on the mailing lists of all departments to receive copies of invitations for bids.

The methods of collecting and disseminating information regarding dealers debarred from bidding on Government business because of unsatisfactory performance under contract has been unified and one list is now prepared and sent at regular intervals to all Government activities requiring this information.

ELIMINATION OF WASTE BY MEANS OF SIMPLIFIED PRACTICE

Simplified practice means the reduction of variety in sizes, dimensions, and immaterial differences of every-day commodities, the purpose being to eliminate waste, decrease costs and

increase values in production, distribution and consumption. Great advancements in living standards are usually brought about by new and basic inventions, but an even larger field of opportunity has been found in the elimination of economic waste. Usually we think of waste as something unused, a surplus, perhaps, of a quantity of material left unsold and which may perish. Waste is something more than that; labor that is unemployed is wasted, and seasonal operations frequently involve waste.

The program of simplified practice, which has been under way for some time, looking to the elimination of the unnecessary varieties in commodities, does not affect commodities which are based on style, art, or other expressions of individuality.

The United States Government has tackled the problem of waste in industry through the Division of Simplified Practice of the U. S. Department of Commerce. The activities of this division are purely coöperative in character. Its chief function is to serve, when requested, as a centralized agency to bring producers, distributors and consumers of specific commodities together and to support the recommendations of those interested when they shall mutually agree upon simplifications of benefit to the industries and the public concerned.

During the last five years the Division of Simplified Practice has coöperated with more than 400 industrial groups in the elimination of excessive varieties, sizes, types, etc., of commodities which these groups either manufacture or use. The savings to these groups have amounted to millions of dollars annually through the reduction of stocks, lowered production costs, improved quality of product, and increased purchasing power of the consumer.

A glaring example of variety of purchase of any one commodity as to size, type, quality, etc., by the Federal Government, is that of envelopes.

It is roughly estimated that two years ago there were over 200 different sizes and grades of envelopes used by various departments and establishments of the Government. These were secured either by Post Office Department contracts or through requisitions on the Government Printing Office. Award of contracts on envelopes for the current fiscal year was made on the estimated requirements of 241,090,500 at an estimated cost of $396,429.77, at an average cost of 64 cents per thousand.

The estimated requirements for envelopes for the current fiscal year shows but 60 item numbers, making a reduction of 140 in the sizes of envelopes used by the Federal Government today.

STANDARDIZATION IN GOVERNMENT PROCEDURE

Modern business administration shows an increasing tendency to become standardized. In large organizations standardization is essential to the establishment and maintenance of a unified business policy and to the coördination of the activities of the several departments of the business.

Before proceeding to the application of standardization to Government purchasing, it may be well to consider briefly some of the principles of standardization.

Standardization, like efficiency, is not an easy term to define and is not always understood in its true sense. It might be defined as the adoption of the best practice in the unification of the methods and processes of industry or general business, or other lines of endeavor which involve repetition of work. Standardization may be considered under several aspects.

Standardization of nomenclature en-

ables purchaser, seller, and manufacturer to use and understand the same language. It is very important that terms used in specifications and contracts be concisely definite. This alone would greatly facilitate the efficient handling of purchases and deliveries to meet specific needs. Most of the specifications today contain ambiguous language, and this should be corrected.

Standardization of variety, or simplification, involves the elimination of unnecessary types, shapes, grades, and sizes of manufactured articles. Waste in industry is largely due to an overmultiplicity in the number of products, as well as to inefficiency of process. There is also a large waste due to deterioration, obsolescence and capital charges carried on idle stock of unnecessary material and products. "Survival of the fittest" will undeniably result from simplification, if handled with good technical advice. Standardization, furthermore, is essential to speed in production.

Standardization of dimensions ensures ready interchangeability of supplies, and the proper inter-working of parts which may be manufactured or assembled by different manufacturers. Standardized parts manufactured in different plants can be assembled into the completed article, disassembled and reassembled with the assurance that all the respective parts are interchangeable.

From a broad viewpoint, standardization may be applied to materials, methods, products and uses.

One of the most difficult disputes to settle in purchasing is the continual quarrel between quality and price. This situation can be cleared only by proper and adequate specifications. Purchasing by bids based on well formulated specifications really sets an upper and lower limit to the quality. The too good is eliminated in the price comparison of bids; the too poor is rejected by the minimum quality specified. The result is that the deliveries are of that good-enough quality range, above and below which lies waste. Net utility per dollar expended is the criterion determining at what level this good-enough quality range shall be set. The specification thus forms the basis on which maker and user meet to determine the quality of manufactured articles. Experience and science unite in making it impersonal and therefore minimize misunderstanding and promote efficiency and economy.

There are many good reasons which should at once impress good business men with the desirability of basing purchases on properly standardized specifications. Lack of standards of quality and specifications, together with inadequate testing and inspection, is costing the business interests of this country tremendous sums each year. This can be corrected by centralized purchasing, based on proper specifications, and followed up by adequate testing and inspection to ensure getting what was contracted for.

The United States Government is the largest purchaser of material and supplies in the world, both as to quantity and variety. The variety of items included in these purchases runs from hosiery to hardware and from forage to fuel. It has been recognized under the new budget system that when the Government goes into the market it must have suitable quality standards on which to base its selections. Efficient procurement has called for the uniform application of approved methods of purchasing to all agencies of the Government. These approved methods require standardized contracts and standardized specifications.

The operation of the General Supply Committee has resulted in standardiza-

tion of supplies used in common by Federal activities, in a reduction of the number of special items purchased, and in a reduction, by reason of the larger orders, in the prices paid. Annual contracts for commodities subject to wide fluctuation in price have been discontinued, and consolidated definite-quantity purchases are being made.

STANDARD FORMS FOR CONTRACTS

Ten years ago the Government had no standard form of contract; no law prescribing the language of the contract; no unified agency to say what language should be used. Some of the larger departments had different forms and different methods in their several bureaus. There were 396 separate forms of contracts and leases and 224 separate laws with which to conform.

To estimate the great waste that resulted from such a condition of affairs is next to impossible, and the first great work of coördination was a revision and standardization of the Government's contracting activities.

Up to February 1, 1927, such Standard Government forms as Invitation for Bids; Form of Bid; Instructions to Bidders; Construction Contract; Bid Bond, and Performance Bond, had been adopted and made effective.

The Federal Specifications Board is composed of one member from each department and establishment which purchases materials and supplies in accordance with specifications. The Board has 76 technical committees handling the details under the supervision of the vice chairman. These technical committees have been formed in recognition of the fact that generally the opinion of a small group of qualified individuals is better than the opinion of any one expert, and that difference of opinion can best be eliminated in informal conferences.

In the Government service there is the greatest aggregation of technical and scientific talent to be found in this country, covering every branch of knowledge, and the best of this talent is utilized in the personnel of the various technical committees.

A specification is selected or written by the technical committee concerned, which will be suitable for the uses of all departments and independent establishments of the Government. The coöperation and advice of interested commercial and industrial concerns is requested, and their recommendations are fully considered by the technical committee. The specification as agreed upon by the technical committee is then submitted for comment and criticism to all departments and establishments of the Government, through their respective representatives on the Federal Specifications Board. At the same time a copy of the proposed specification is submitted to the American Engineering Standards Committee, with a request for their informal assistance in securing comment and criticism from the various interested engineering and and technical societies of the country. All criticisms received are referred back to the respective technical committees for consideration on their merits.

When the specification is finally agreed upon, it is promulgated by the Federal Specifications Board as an official United States Government Master Specification for use in connection with the purchase of material covered by the specification.

This preparation and use of master commodity specifications for the entire Federal Government is an essential step toward the economy resulting from the purchase of materials and supplies in large quantities. In no field of Government operation was there greater need for constructive work than in the field of purchasing

standards. For certain classes of materials and supplies there were almost as many variations in the department's specifications for a given article as there were specification writers. These specifications were developed through the years, and bore the impress of notions, whimsicalities, and idiosyncrasies of officials long since departed. The Government has paid large sums of money for this lack of standardization.

In the selection of specifications for Government use, the Federal Specifications Board is coördinating the interests of the manufacturer and the consumer in a manner which is fair to and understood by both. Eventually all Government purchases will be based on correct standards of quality and practice.

Up to the present time, 551 United States Government Master Specifications have been promulgated, covering all of the more important commodities, and their use by all the departments, bureaus and activities of the Government, has been made general by direction of the President.

INSPECTION AND TEST OF MATERIALS

A gradual extension is being made of the use of the inspection service of one department by others, thus eliminating travel and overhead expenses and giving flexibility to the Government inspection service.

For example, inspectors of the Bureau of Animal Industry, Department of Agriculture, inspect provisions and meats for Government hospitals in Boston; for U. S. Shipping Board in New York; for the Army and Navy in many places.

The Secretary of the Navy has made available to all activities of Federal Government the services of Inspectors of Naval Materials. This inspection service will be rendered upon request and will be charged to Federal activities at cost.

The field inspection activities of the Navy are located in various cities throughout the northern, eastern, and western parts of the United States. The southern area has no central inspection office, so inspections in that area are provided for by ordering inspections to be made by whichever office, as determined by the activity ordering the inspection, shows the travel costs of the inspector to be the lowest.

Within the Naval Inspection Districts there is a total of twenty residencies where inspectors are based. These inspectors are qualified to inspect such material as timber, machinery, electrical apparatus, non-ferrous metals and products, boiler tubes, fuel oil and other materials in naval and in general use.

The Post Office Department has recently made arrangements to consider any reasonable request from, and to render service to other departments and establishments in connection with the repairing or storage of motor vehicles owned or operated by Federal activities and to make sales of gasoline and lubricating oil to them, provided it can do so advantageously to the Federal Government and without detriment to the Post Office Department.

The existence of standard specifications and the general use of all Federal inspection services are a very efficient protection against unscrupulous dealers in making Government purchases.

Standardization of materials and manufactured products is believed by engineers and economists to be the coming great principle in business and industry.

Standardization of Farm Products

By Lloyd S. Tenny
Chief of Bureau of Agricultural Economics, U. S. Department of Agriculture

THE development of national standards for farm products has been a process of evolution. At a relatively early date agriculturists who followed the trend of commerce and industry studied in an experimental way the potential benefits that would result from the use of national standards in the handling of cotton and grain, but established trade practices yield slowly to change and improvement, and such changes as do occur are largely the result of economic necessity.

Prior to the organization of the Bureau of Markets (now the Bureau of Agricultural Economics) in the United States Department of Agriculture in 1913, practically nothing had been accomplished in the field of national standardization of farm products. In 1914 the passage of the Cotton Futures Act definitely established the department in this work. In 1916, the Grain Standards Act was passed. The United States Warehouse Act of 1916 also provided certain authority for the promulgation of standards. The use of the official cotton and grain standards of the United States was required in all transactions based on grade, and any standardized grades which may be formulated and issued under the Warehouse Act are also mandatory for the purpose of the act. Besides serving the particular industries these compulsory standards were designed to aid, their use demonstrated to others some of the advantages to be gained by standardization and paved the way for expanding the work.

But the real progress in agricultural standardization has been made during the recent period of agricultural depression when every function of our marketing machinery has been tested with a view to the elimination of waste. The movement has been further expedited by the development of specialized agriculture which has rapidly changed the marketing of farm products from a local or regional problem to one of national and even international significance.

The standardization of agricultural products, although in many respects a part of the general movement, stands by itself, in that problems of standards having to do with the natural products of the soil, and of animals require peculiar attention.

The means used in securing the standard products and practices may not be important. We may secure them through coöperation between members of the industry, through consolidation or concentration of industry into a few large companies or associations, through the use of Government agencies, or even through law as a mandatory matter. The means used may be different, but the result must and will be much the same —*the products will actually be standardized*. When that has come about, we will have the sound platform or foundation on which we can build a successful industry.

Benefits of Standardization

Standardization is basic to successful marketing. Moreover, it is the definite foundation on which rest most of the individual functions which go to make up the whole process of marketing.

Only a brief review of its benefits is needed here.

Standardization supplies a common language for commerce. It makes general the use of certain terms the exact meaning of which is understood, in just the same way, by the producer who may be in the far West and by the dealer who may be in New York City and by the buyer or commission merchant who may be located in Chicago. Thus a choice grade steer is a choice grade steer whether it is being sold on the range or handled in the Chicago stockyards or sold on an Eastern market. Moreover, a roast from a choice grade steer is now a choice roast, whether bought in Chicago or New York.

Standardization is essential to the upbuilding and maintenance of any nation-wide quotation or market news service, and essential to the user if he is to be able to compare market prices and make a choice of markets. One of the first demands on the Bureau of Markets was for the organization of a telegraphic market news service for fruits and vegetables, in 1914. This service was scarcely under way before it became evident that growers and shippers had no way of knowing whether variations in prices in the reporting markets represented differences in the market demand or simply differences in the actual quality of the product. It became evident that standardization would have to be developed side by side with the development of the market news service.

Standardization is basic to the safe and successful use of credit. Particularly is this true when farm products are to be used as collateral for loans. The United States Warehouse Act, under which warehouses that meet certain requirements are licensed by the U. S. Department of Agriculture, requires that whenever grades are specified on the warehouse certificates, which are commonly used as collateral for loans, they shall be specified in terms of United States standards.

Standardization is the one safe basis for advertising—standardization in both output and product. In the long run it is useless and wasteful to advertise a product of which there is not a dependable supply at all times or to advertise a product that does not come up to the advertised description and bring satisfaction to the consumer.

Standardization makes possible the analysis of the production and the marketing of a commodity, the analysis of the business in that commodity, and it makes possible the analysis of a production region or of a market. It renders the analyses of various production regions comparable, and the same with analyses of markets.

Standardization facilitates the settling of disputes as between shippers and dealers, buyers and sellers; it offers a safe basis for the settlement of claims and damage suits. It is the only safe basis upon which equitable inspection services can be built either at shipping point or in the markets. It is especially useful in coöperative marketing in that it affords a basis for pooling the products of various growers to enable all to share alike in the season's sales.

METHOD OF WORK

Although from time to time the Government has found it necessary or desirable to enact legislation making improvement through standardization imperative, its usual method is to bring about the needed economic improvement largely through education. Even the compulsory laws have usually been preceded by much educational work.

All of this work toward standardiza-

tion of agricultural products is carried on by well-trained and experienced workers in the United States Department of Agriculture. The development of the standards for each commodity is in the hands of specialists who, in each case, have devoted years of intensive work to the study of the marketing of the commodity involved. The standards as drawn up by the specialists are tested experimentally by actual commercial use; and public hearings at which comments and criticisms can be offered are usually held before any standards are promulgated.

If laws are passed making the use of any of these standards mandatory in interstate or foreign commerce, the enforcement of these laws is usually entrusted to the Department of Agriculture with a feeling of confidence, on the part of Congress, that the Department will enforce them intelligently, sympathetically, and with more educational than punitive work.

It must not be supposed that Federal standards for farm products necessarily reflect the true market value of the product. There are several reasons why they may not. For instance, there are frequently certain factors which strongly influence market quality for which no practical method of measurement has been devised for use in commercial operations. Until comparatively recently the important factor of protein determination in wheat was ignored in commercial operations although it was given indirect recognition by paying a premium for wheat from sections where the average protein content was high.

Then, established trade practices have frequently associated the grades of which standards are composed with a limited number of factors. Thus cotton is graded chiefly on the basis of color and freedom from trash, whereas length of staple, equally important in trading, is dealt with separately. The complexities of grading have sometimes made it necessary to confine the grades of a standard to a single factor. The United States wool standards, for instance, are based wholly on diameter of fiber.

PRACTICAL ASPECTS

Let us turn to some of the practical aspects of the work resulting from grain standardization. It is recognized that the inspection and grading of grain is not a precise science, as there are several factors of grading the determination of which requires the exercise of human judgment. This presents the problem of correct and uniform application of the standards by all inspectors at all markets. To meet this, the Department has divided the country into supervision districts with an office of Federal grain supervision at the principal grain markets.

Milling and baking investigations are conducted in connection with the enforcement of the Grain Standards Act. Such investigations have been made of the various grades and classes of wheat marketed in commerce. The investigations yield information which should lead to the development and production of superior wheat. Other investigations relate to the influence of weed seeds, garlic and frost and heat-damaged kernels on the milling and baking value of wheat.

In the case of the work with livestock and meat, the standardization of which has been a very complicated problem, the resulting standard schedule is sufficiently elaborated to care for the trade as conducted on our largest and most highly organized markets; it is also so arranged that it serves the purpose of the smaller markets where demands are not so exacting and where less fine distinc-

tions are made. The use of this schedule makes the following things possible: (1) It enables the buyer to get the animals he needs without buying some for which he has no use; (2) it makes possible an accurate determination of values; (3) it enables the producer to sell his livestock strictly on its merits, and (4) by providing a name or label for each group and having the meaning of such group names clearly understood by all interested parties, it makes possible accurate and intelligible market reporting.

The United States Shipping Board, an increasing number of international and coastwise steamship lines, Federal and state institutions, hospitals of the Veterans Bureau, chain restaurants, and dealers are making their purchases of meats according to specifications based on the meat standards with marked savings and with general satisfaction as results.

Our standardization work on wool represents the results of much cooperation and is also an example of international work toward standardization. The United States standards for grades of wool and top, covering diameter of fiber only, have been promulgated after much coöperative study by the Department of Commerce and the Department of Agriculture, after thorough testing in tentative form, and after they were endorsed by the Research and Standardization Committee of the wool and textile industry, by wool producers, and the wool trade. They are compulsory for use in the grading of wool stored in warehouses operating under Government license, but are otherwise optional.

This joint committee further recommended that the departments interested consult with authorities of the British wool and textile industries to the end that a correlation of the United States standards for wool and the British classifications for wool could be effected, and a system of nomenclature worked out that would take cognizance of the wool imported into this country.

Through the coöperation of the Bradford Chamber of Commerce, of England, and representatives of the English textile industries, including spinners, manufactures, export merchants, and the British Wool Federation, the work of correlating the proposed United States official wool standards and average Bradford qualities was carried on by a committee composed of members of the British Wool Federation appointed by the Bradford Chamber of Commerce, in coöperation with the American committee. The English committee suggested that standard grades for top be established corresponding with the diameter of fiber in the wool standards. This suggestion met with the approval of the American committee. At the conclusion of the conference between the English and American committees, the Bradford Chamber of Commerce, acting for all of the allied wool textile associations in Great Britain, advised that the action of the British committee had been unanimously approved by the Chamber.

ESSENTIALS OF THE STANDARDS

In no two large groups of commodities can just the same factors be considered in formulating standards, or just the same methods be pursued, or just the same mode be used to place the standards in expression for practical application.

Cotton.—In the case of cotton, each practical form consists of a box made of heavy cloth-covered pasteboard in which are placed samples of twelve bales, all of the same grade. To this box is attached a hinged cover, on the

underside of which is mounted a photograph of the samples showing the size and position of the foreign matter originally present on the surface of the cotton and the quality of preparation. The photograph bears an imprint of the seal of the Department of Agriculture and a certificate of the Secretary of Agriculture dated and signed by him or by another official designated for the purpose. The twelve samples, which each box contains, not only show the range or variation of leaf color and preparation allowed within that grade, but represent regional differences as well. For convenience of reference, each sample is given a numbered position in the box. Official standards for staple have also been established and practical forms of the standards are available for certain of these lengths. These standards have now become universal standards for American-grown cotton.

There are also seven basic grades of cotton linters, ranging from the highest first cuts to the shortest second cuts. Each box representing a grade is made up of twelve samples. The gradation is based chiefly on the proportions of long fiber and fuzz with a slight increase in the quantity of foreign matter permitted. Each box as a whole shows the expectant variation both in the character of the fibers and in the quantity of foreign matter generally to be found in bales of linters turned out by carefully managed oil mills.

Grain.—Generally speaking, the factors which determine the commercial grade of grain are moisture content, weight per bushel, freedom from foreign material and other grains or other classes of the same grain, damaged kernels, in certain cases, color and texture of kernels, freedom from objectionable dirt and general condition, that is, whether the grain is cool and sweet or whether it is musty, sour, heating, or hot. These are the factors of prime importance for commercial trading purposes.

For standardization purposes grains are divided first into classes and subclasses. For example, wheat falls into five classes as follows: Hard Red Spring, Durum, Hard Red Winter, Soft Red Winter, and White wheat. In each class there are two or more subclasses.

The official grain grades are designated by number. For instance, there are five grades of wheat and a sample grade which is provided for off grade grain which is sold subject to inspection of the buyer. Special wheat grades are provided for mixed wheat, mixed durum, treated, garlicky, smutty and weevily wheat.

Official standards have also been established for shelled corn, oats, rye, grain sorghums, feed oats, mixed oats, barley, rough and milled rice.

Livestock.—Livestock are separated into various groups before actual grading by official standards is done. In this grouping *kind* refers to the species, as cattle, hogs, or sheep; *class* separates cattle, for example, into steers, heifers, cows, bulls, and stags; and *sub-class* provides for subdivisions based upon the relative desirability of the animal for certain rather general purposes as slaughter, feeder, or stocker.

These sub-classes based upon general use are not sufficiently accurate to cover all needs of the trade; therefore it is frequently necessary to provide additional subdivisions based on particular suitability for certain special uses. Thus, slaughter hogs are divided into butcher, bacon, and packing hogs. Further segregations are made on the basis of age and weight. Certain classes of consumers still require heavyweight cuts of meats, but there is a

rapid shifting of demand to lightweight cuts. Stockyard operatives sort animals to obtain cuts which will meet these requirements. Finally, the standardized grades for livestock are based on three basic factors—conformation, finish, and quality.

Wool.—The factors of importance in determining the value of wool for certain purposes are four: Diameter of fiber, length of fiber, spinning quality of fiber, and amount and character of shrinkage. Our present standards are based wholly on diameter of fiber. This is a basic factor, since there is a more or less consistent relation between fineness of wool and variations in certain other factors.

In the establishment of these standards the requirements of the producers and merchants of the United States are adequately provided for. Sets of seven official grades will be prepared and distributed, each of which can be used as a basis for grading entire fleeces of wool. Either numerical designations or the American nomenclature may be used for these seven standard grades.

Sets of twelve standard grades will be issued and each grade may be used as a basis for the necessary division of the qualities found within fleeces when wool is sorted for manufacture. The grade terms for the sorting grades are grouped and correspond with the grade terms for grading wool. The international character of this work has been outlined.

Hay.—Each group of hay in United States standards has its classes, grades, and definitions. In all United States hay standards the term "class" is used to describe the kind of hay or the mixtures of various kinds, and has no reference whatever to quality or condition. Class names, such as Timothy, Clover, Alfalfa, and Timothy Light, are as descriptive of the kinds and mixtures of hay as necessary terseness will permit. The first word in each class name usually indicates the kind of hay which predominates in that class. Succeeding words, if any, in the class names, indicate the kind of hay mixed with the predominating kind and whether the mixture is comparatively light or in an amount too great to be considered as a light mixture.

Each class of hay in the United States standards is based upon definite specifications for the mixtures permitted. The various classes of hay in United States standards have been designed to include all of the well-defined kinds and mixtures of hay that are of chief commercial importance in the United States.

In some of the hays, color is the most important grading factor; in others, the grading factors are leafiness, color, and foreign material, of which leafiness is the most important.

The numerical grades and sample grade define the quality and condition of the greater part of the hay crop of the United States. They have been designed to cover the bulk run of the good, fair, and poor quality hay in the trade. In United States standards the numerical grades are supplemented with special grades to describe and emphasize the unusual superior or inferior qualities of certain kinds of hay.

Beans.—For standardization purposes dry edible beans are divided into nineteen classes such as pea beans, red kidney beans, marrow beans, and medium white beans. Each class is divided into three numerical grades with the exception of Lima and Baby Lima beans, for which there are but two grades. Beans which do not meet the requirements of the standard grades are designated sample grade. The grade or quality of beans depends on their wholesomeness for food as evi-

denced by their general appearance, and degree of freedom from moisture and such defects as split beans, damaged beans, foreign material of any nature, and mixtures of other kinds or classes of beans.

A separate set of standards has been provided for soy beans which are divided into five classes. The grades are based upon variations in the following quality factors: Condition and general appearance, minimum test weight per bushel, moisture, split and damaged beans, and foreign material.

Broomcorn.—For the purpose of standardization broomcorn is first divided into four classes according to length. The standards contain seven grades and a sample grade for lots of low quality which do not meet the requirements of the standard grades. The grade of the bale is determined by the percentage of each quality of hurl and underwork in a representative sample. Hurl is long or overlength brush. The quality is determined by the color, fineness of fiber, and relative freedom from defects which lower the quality of the brush. Underwork includes all short or medium brush, and long and overlength brush, which do not meet the requirements of hurl. The same quality factors apply. The grade of broomcorn is determined on the basis of the lot free from damage.

Tobacco.—According to the official classification of the Department of Agriculture all American-grown tobaccos are divided into six classes. The first three are based on the method used in curing; the remaining three are based on the principal use for which the tobacco is grown. These classes are: Flue-Cured Types, Fire-Cured Types, Air-Cured Types, Cigar-Filler Types, Cigar-Binder Types, and Cigar-Wrapper Types.

There are several types of tobacco in each class. A type is defined as a division of one of the main classes the peculiar characteristics of which permit its being divided into a single system of grades. Grades have been prepared for all the leading types except Burley and tentative grades for Burley are in course of preparation.

Tobacco is graded on the basis of the following factors: (1) Group; (2) Quality; (3) Color; (4) Length. The last two factors are not always of sufficient commercial importance to be included in the grade. The six groups are: Wrappers, Heavy Leaf or Cutting Leaf, Thin Leaf or Cutters, Stemming Lugs, Granulating Lugs, and Priming Lugs. There are seven regular divisions of quality and an additional eighth quality in Leaf, a Scrap and Sample in Lugs, and a Damaged.

Fruits and Vegetables.—The terminology used in fruit and vegetable grading has been placed on a numerical basis with the exception of certain premium grades provided for products of exceptional quality which have been designated U. S. Fancy. The U. S. No. 1 grade is in all cases intended to include the major portion of the commodity which has customarily met the requirements of the best commercial grade.

In general, the factors considered in determining the grade are: (1) Variety; (2) market quality based on the state of maturity, general appearance including desirability of shape and color and relative freedom from such defects as cause waste or unreasonable deterioration; (3) size.

In trading in these products it is necessary for buyers and sellers to specify either the specific variety as "Winesap apples" or the type as "Round white potatoes." In some grades the minimum size of the product is specified, but where this is not the case the specifications must also be

in addition to grade as "Winesap" apples U. S. No. 1, 2½ in. min. As fruits and vegetables are graded, packed, and branded, at point of shipment, and as subsequent deterioration is inevitable, such factors as overripeness occurring in storage or in transit are considered as affecting the condition rather than the grade.

Federal standards have been developed for thirty-four fresh fruits and vegetables. In some instances more than one set of standards have been developed for a commodity. In the case of onions, for instance, separate standards have been established for Bermuda onions, for Creole onions, and for northern-grown onions. Such subdivisions of the work bring the number of sets of standards for fruits and vegetables up to forty-four.

Fruits and vegetables for canning purposes present special problems, but these are being cared for, and progress is being made in standardization work relating to peanuts, honey, and eggs. The work toward standardizing the containers used for shipping fruits and vegetables in interstate commerce was among the Department's first highly successful standardization work and was supported both by law and by popular opinion, but further standardization work on containers is yet to be done.

The standardization work of the U. S. Department of Agriculture has proved to be one of its most interesting and satisfactory lines of economic endeavor during the past two decades when judged by progress made, benefits derived, and endorsement by the public. We have completed the fundamentals of the work, and although each commodity has its peculiarities and its problems, we have mastered so many of them that we feel confident we can ultimately formulate standards for all of the factors of all of the commodities.

Standardization in the Household

By Alice L. Edwards
Executive Secretary, American Home Economics Association

IN industry, where the materials used are measured by almost appalling figures, where employees run into the thousands and the plant covers acres, it is easy to demonstrate the wisdom of buying by specification and of standardizing both the processes of manufacture and the product. Convenience and economy are alike served, and competition often compels it.

Conditions in the individual household are very different. Here we have small, more or less isolated units, not engaged in business competition, and often so strongly influenced by family custom that the attempt to introduce a change is met with the apparently unanswerable argument "It isn't done that way in our family."

It is true that habits and routine in individual homes have often developed to the point where they could almost be called standardized practices. So much variation is found, however, between practices in such otherwise similar homes that they cannot be said to conform to any but their own individual standards. Moreover, even those individual standards are less fixed than formerly. Everyone realizes that many processes formerly carried on in the home have passed or are passing out of it. Weaving, for example, has gone entirely into the factory, while such activities as breadmaking, food preservation, laundering, and dressmaking are wholly removed from some homes and only partially retained by others. The old routine is further upset by the fact that families tend to move more frequently from one residence to another and to spend much less time in the house than formerly. The most outstanding change, however, is due to the development of the myriad of appliances, equipment, materials, and public services which are now available in cities and towns and which make living a very different experience from that of our ancestors. In this new world of household conditions the value of standardization is inevitably making itself felt.

The Homemaker's Interest

The attitude of the homemaker toward simplification and standardization is naturally different from that of industry. She is not primarily concerned in the processes of manufacture or in the specific materials going into a piece of equipment or fabric. What she is much concerned about is the performance and use value and, to varying degrees, the esthetic qualities of the article in question. She is much more interested, for example, in the wearing quality of sheeting than in the length of the cotton fiber or the twist of the thread from which it is made, although she knows that these have a relationship to wearing value; how much she cares to spend for fineness and smoothness of texture is a matter of individual taste and purse. Articles of household use represent such a multiplicity of manufacturing processes and raw materials that the housewife must concede her inability to familiarize herself with all of them. She is willing to leave these technical matters to the manufacturer, providing only that she be helped to answer such questions as how it will wear, what kind and how much service a thing will give her, what will be the operating cost.

POINTS OF ENTRANCE

Trained, observant homemakers who have been watching the development of efficiency engineering and standardization in business and industry and considering their value in solving some of the problems in the home find that standardization is entering or may enter the home in various ways. It may influence the house itself, its plan, the building materials, and methods of construction; the equipment and furnishing; the family clothing; the food; the household processes.

UNIFORMITY IN HOUSING

In comparing the houses of a century or more ago with those of today, the tendency toward standardization is conspicuous. The detached house gives greatest opportunity for individuality, but even here cost is a factor which encourages standardization. How far this may be carried is seen in the ready-cut houses which are shipped direct to the purchaser with all parts ready to fit together and all necessary supplies included, even to hardware, paint, and plumbing. It is worth noting, however, that in spite of this standardization of parts the catalog of one make of such houses advertises ten separate models with possible variations in floor arrangements which bring the total number of plans for which they are applicable to thirty-five. Still more significant is the standardization shown in the realty developments with block after block of practically identical houses. Even where the owner builds for himself he often sacrifices individuality to economy by using ready-made plans. The work of the Small House Service Bureau, affiliated with the American Institute of Architects, is noteworthy in this connection because its designs allow for standardization and economy of materials and construction while they furnish variety of plan and permit individuality of detail. It is in the apartment house, however, that uniformity in housing seems to be reaching its climax. When one sees not only tier after tier of similar apartments in one huge house, but row after row of exactly similar apartment houses, one can hardly question the reality of standardization in the household.

STANDARDIZATION OF HOUSEHOLD EQUIPMENT

Other allies of standardization in house plans and construction are the housing and sanitary codes which in many cities predetermine certain minor features. Even more general is the influence of the standardization followed by manufacturers of such articles as window and door frames and materials for electric and plumbing installations. The simplification and standardization which has been adopted in electric light sockets, light bulbs, switches and plugs is both a convenience and economy, and the standardizing of attachments for electrical apparatus is encouraging the more extensive use of electrical equipment. The standardization of electric motor frames in which the American Engineering Standards Committee and the National Joint Electrical Manufacturers are taking the lead will be of interest to those using electric power in their homes. It is encouraging to learn that standards and specifications are being developed to simplify the matching of faucets, bath-tub fittings, and other plumbing devices.

Although there are perhaps fewer examples of standardization in household equipment than might be expected when one considers what is happening in industry we find considerable development wherever distributors or consumers have brought their influence to bear. The American

Gas Association is adopting standard specifications designed to represent good practice in gas appliances with the result that a consumer buying a gas range with the label of the Association is now assured that it will be safe and reasonably efficient. Devices greatly appreciated by the housewife are the heat regulators for gas ovens and the thermostats for the control of room temperatures.

Under the auspices of the Division of Simplified Practice of the United States Department of Commerce committees representing manufacturers of refrigerators and the ice industries are considering simplification both in the sizes and shapes of ice cakes and in certain parts and dimensions of refrigerators, while conferences called by the American Engineering Standards Committee at the request of the American Home Economics Association and the American Institute of Architects look forward to the establishment of specifications for the performance to be expected of such equipment. Closely related to these attempts are the investigations which the Bureau of Home Economics of the United States Department of Agriculture is carrying on with domestic refrigerators, including their performance and cost of operation.

Through conferences held under the auspices of the Division of Simplified Practice of the United States Department of Commerce recommendations have been adopted reducing to only a few sizes each, bedsteads, springs, mattresses, blankets, and pillows. This may work a temporary inconvenience to the fastidious housekeeper who can, for example, no longer buy some favorite but unusual size of blanket but she will soon realize that what the store offers will meet all practical needs and if she should discover that her new blankets cost a little less she certainly would be quickly reconciled to the change.

STANDARDIZATION OF CLOTHING

Although few of us desire to have our clothing standardized to the point where we go about in uniform, most of us would welcome standardization in sizes, measurements, and certain methods of construction and are glad to know that a start has been made along this line. The Association of Knit Underwear Manufacturers has standardized methods of laundering to prevent undue shrinkage. The National Association of Hosiery and Underwear Manufacturers have standardized their methods of measurements of sizes. The International Association of Garment Manufacturers have effected the standardization of dimensions of their products, mainly outside garments. An interesting illustration of standardization in garment construction appears in the resolutions recently adopted by the Fur Retailers of America which call upon members to follow certain specifications in the construction of fur garments.

As regards standardization of the wardrobe, almost every amateur social philosopher has pointed out that women are far behind men. Without going into the intricacies of social conventions and feminine versus masculine psychology, it is only fair to say that under present conditions a woman finds it by no means easy to standardize her wardrobe. Many a busy woman who has hoped to save time and mental effort by sticking at least to the same types of underwear, shoes and gloves will testify to the discouraging frequency of the reply "We do not carry that any longer, Madam."

FOOD PRODUCTS

The value of grading and standardization has been made clear to the

producers of food products through coöperative marketing. This has been strikingly illustrated in the case of the citrus fruits and apples from the west. Government supervision and control during the World War also demonstrated the value of grading and standardization so that government standards have been developed for such products as fruits, vegetables, peanuts, honey, butter, cheese, eggs, and meat, and inspection of certain foods has been inaugurated in important distributing centers. Although these standards are for the wholesale trade they materially influence the character, quality, and often the pack of the food which comes into the house. In the retail markets of two or three cities meat has recently begun to appear with the government inspector's stamp showing on every cut.

The Pure Food and Drug Act of 1906 not only checked misbranding and adulteration of food and insured for the home a safer, more healthful food supply, but it has led to the establishment of legal definitions or descriptions which are in effect standards for certain qualities. The states have largely based their food and drug laws on this federal act, establishing for themselves more specific standards. Another very valuable government service has been the standardizing of the various containers for marketing fruits and vegetables, eliminating false measures and deceptive shapes. The standardization of milk bottles and caps has had the further advantage of making them more sanitary. The requirement that the net weight of contents shall be stated on the outside of the package furnishes a standard for judging the relation between price and quantity. For cost comparisons to be easily made, it would be well to limit and simplify the number of net weights of packages in which materials of different types may be marketed; few of us, for example, will take time to calculate the relative cost of an ounce of chocolate from a $3\frac{3}{4}$ ounce package @ 10 cents and a $5\frac{1}{8}$ ounce package @ 15 cents.

That standardization of certain types of commodities falls in with housekeepers' purchasing habits was brought out in a recent study of consumer demands for apples in New York City. There it was found that the consumer was distrustful of an unstandardized pack and that her choice was largely influenced by such factors as uniformity, appearance, and familiarity. Although there were more than one hundred varieties on the market, only fifteen were mentioned as preferred for eating raw and five for cooking, and the report adds, "This would tend to show that variety standardization is beginning to manifest itself very strongly in the marketing scheme and that the number of varieties of commercial significance are narrowing down to a relative few."

Apparently with a product such as apples, where there are frequent purchases and where the housekeeper can judge readily of the satisfactoriness of the product, she does not seek wide variety once she has found the apple which meets her needs, but buys that over and over again so long as it is on the market. On the other hand, in the case of manufactured products where standardization has not been established, where quality and value are not readily determined, or where purchases are infrequent, she probably gives less attention to replacing an article by one of the same kind. This may often be due to the fact that she is distrustful of her previous choice and hopes that another kind may prove superior.

Since more and more goods are being sold under trade-marks and brand names, it is of especial importance to the housewife that correct standards

should be established for such goods and that the labels and advertising give specific information as to quality and performance value instead of the general high-sounding phrases which convey no real information. On her canned vegetables, for example, she would welcome more understandable terms than fine, superfine, and extra fine. At present many wholesalers and retailers have their own set of trade names to designate the grades of their own goods, which often only the initiated understand. Standardization in such terminology would be of inestimable value to the housewife who cannot hope to ferret out the significance of the present names of all the products offered for her choice.

Another reason why the housewife is so concerned in the standardization of household goods and equipment is that she has found it impossible to standardize her own work and products without this service. This is perhaps best illustrated in cooking, for standardization in cooking depends upon standardized equipment and reasonably standardized food materials. She has been the subject of many a laughing gibe because of the vague terms used in recipes as, "cook to the soft ball stage," "season to taste," and "bake in a medium oven." Upon investigation it becomes evident that she has had to work with very inexact equipment and with widely variable materials. How can we expect to standardize a product when the materials used in it vary widely from time to time in their composition, flavor, and texture, when utensils are unstandardized, and above all when means for controlling temperature in cooking are inadequate? The research experts will recognize in these variables enough to discourage the most persistent.

It would seem a simple matter to secure a reasonably accurate half-pint measuring cup, but the story of the attempts to accomplish that is long and not ended; most housekeepers would be surprised at the results of comparing the capacities of the cups on the market, yet there is much less variation now than formerly. The oven, deep fat, and candy thermometers, although not any too accurate, are aiding in the removal of guesswork and the development of standardization of procedure and results in a number of cooking processes. But of all equipment contributing to working efficiency and accurate results in cooking, none is so important as a stove which will furnish easily controlled and reliable heat.

Influence of Standardization on Price

The influence of standardization on price is of course one which closely concerns the ultimate consumer. He recognizes that the adoption of simplification should lower costs of production and distribution and he trusts that a due proportion of this saving will ultimately affect the price he pays. As regards standardization according to quality or performance, the case is not entirely simple. Some manufacturers have objected to standardization of certain household equipment because they believe that it will "step up the manufacturing program" to a very high quality product, and that the housekeeper will not be willing to pay the necessarily increased price for the better article. The housekeeper, on the other hand, is becoming more insistent that she be given the facts as to the performance ability or quality of the various articles from which she has to choose, so that she can decide for herself whether it is wiser to pay the extra money required for the higher grade or make a smaller investment in an article of a lower standard. She has learned from experience that in many

lines price is not a reliable guide to quality, especially not in goods whose real value is difficult to judge. In such cases the intelligent housewife realizes that her hope lies in the devising of some means by which she is guaranteed the necessary information, and she is coming more and more to believe that she is justified in demanding this.

PROGRESS IN EUROPEAN COUNTRIES

In various European countries consumer interest and activity in efficiency and standardization in the home seems to be more marked than in this country, probably because of the greater economic stress. Of interest in this connection is the fact that at the last International Congress of Scientific Management a resolution was passed to organize a section on household efficiency for the Congress to be held in 1930. Prominent in this movement were delegates from Czechoslovakia. At the Fourth International Congress of Home Economics held in Rome in November, 1927, the resolutions adopted included one calling for the study of "simplification" and "rationalization" of all phases of household work and its introduction into all schools of household management.

The Deutscher Normenausschuss, the German equivalent of the American Engineering Standards Committee, lists a variety of household commodities among the articles whose production has been standardized and is in active coöperation with such organizations of household consumers as the Reichsverband Deutscher Hausfrauenvereine and the Reichsverband Landwirtschaftlicher Hausfrauenvereine, national federations of the German organizations of housekeepers. The Austrian Society for Technique in the Household (Österreichischen Gesellschaft für Technik im Haushalt) maintains a testing bureau and publishes a semi-monthly bulletin with reports on equipment which has passed its tests. German interest in the subject is shown by the fact that what is apparently the first book in which the detailed design of ordinary household articles, such as water-bottles, knives, and forks, is discussed from an engineering point of view, is "Der Neue Haushalt" by Dr. Erna Meyer.

An excellent example of consumer demand bringing standardization into the home is found in Norway where in 1925 the National Council of Women asked the Department of Agriculture to aid them in securing reliable information concerning electrical equipment. Durability, insulation, evenness of heat distribution, consumption of electricity and actual suitability of the electrical ovens at that time on the market in Norway, were studied. No grading was done, but the results of the experiments were published in the report so the customer had facts upon which to base decision when making a purchase. It was reported that one make of oven which was found to be decidedly superior was the one least advertised and accordingly least known. The influence of such tests on manufacturers was shown by the action of an important firm, which, when it heard that its oven could not be heated to the temperature required for searing beef, asked to be allowed to substitute an improved type, agreeing to withdraw the unsatisfactory one from the market.

PROGRESS IN UNITED STATES

In this country the legitimate interest of the consumer has begun to be recognized. It has brought about the study of household refrigerators inaugurated by the Bureau of Home Economics and carried on in coöperation with the Society for Electrical Development and the National Association of Ice Industries. As already pointed out, it was the consumer's de-

mand, represented by the American Home Economics Association, which resulted in the meetings called recently by the American Engineering Standards Committee to consider the establishment of specifications for refrigerators, which would take into account refrigerating efficiency. The Association has also made articulate the need of the consumer for standardized sheeting and led in another series of meetings called by the American Engineering Standards Committee for the establishment of standards for sheeting in which the major emphasis is being placed on measurable characteristics and performance of the finished product. Furthermore the Association is actively interested in various phases of the simplification sponsored by the Division of Simplified Practice of the United States Department of Commerce.

Among the official agencies which are contributing to efficiency and standardization in the home, the Bureau of Home Economics in the United States Department of Agriculture, is in an exceptionally good position to interpret the needs and desires of the consumer and hence to give very valuable information to the many inquiring manufacturers, which may result in the production of more satisfactory goods; it can also pass on to the housewife in intelligible language the available technical information about household goods. Unfortunately the fact that trade names cannot be given out by a government agency in such cases lessens the assistance which the household buyer can obtain through this bureau.

To thoughtful consumers a discouraging and at the same time a hopeful feature of the situation is that there already exists, but unavailable to the public, much useful information for standardizing his selection of household commodities. They realize that government standards and specifications are already rendering significant aid to industry and large consumers, and they are beginning to ask that as far as circumstances allow this be put in form useful to the ultimate consumer as well. A few periodicals and advertising agencies maintain laboratories for testing goods whose advertisements they carry, and part of the information thus obtained is given to the readers, but by no means all. A vast amount of information is buried in files of the many testing laboratories connected with industrial plants. The report has come of a decision by the Retail Dry Goods Association to establish a testing laboratory which will prove significant news for the consumer if some of the standards there determined can be placed at the service of the patrons of the retailers. An interesting enterprise in this connection is the Consumers Club recently organized with headquarters at 2 West 43d Street, New York City; technical information regarding specific articles is compiled for the confidential use of members, who in return, report on what their experience shows regarding the correctness of the information supplied.

From all this it appears that standardization of some sort seems to offer to the housewife some hope of rescue from the maze in which she finds herself when she attempts to make wise purchases for her family. It remains to be seen whether assistance will come through the efforts of the manufacturer, distributor, retailer, or consumer, but should economic pressure increase it is reasonable to expect that the retailer and consumer, or even the consumer alone, will demand and obtain needed specifications and standards for the more important household goods.

Standardization and Waste Elimination

By William J. Quinn, Jr.
Chairman, Committee on Standardization and Waste Elimination, American Hotel Association

ONE of the few things we have to be thankful to the World War for is the present demand for Standardization and Waste Elimination: it must be remembered, however, that the writer is referring in this article only to hotels. The subject of standardization first came into prominence when it became imperative to use manufactories for supplying the necessities of war, when men, time, space and material were at a premium. As far back as December, 1921, Secretary Hoover established the "Division of Simplified Practice," which was designed to serve as a centralizing agency in bringing producers, distributors and users together, and to support the recommendations of these interests. From that point on the subject has gained momentum and is being intelligently delved into by many and various industries. It is safe to say that the hotel industry was one of the last to treat the subject in a serious manner.

Division of Simplified Practice

The "Division of Simplified Practice" has included in its work the standardization of many types of tinware, china, glassware, paper, beds and bedding, etc., used by hotels, and which standardization, while not applicable to hotel use in all cases, has aided our industry to a great extent. The Department in Washington cannot consider any one business in its negotiations, and has to include hospitals and institutions of all kinds. What might be acceptable in the way of standardization to hospitals and institutions would not be of use to hotels, and what a hotel of one class could use might be impossible for a hotel of another class to even consider. A hotel on Park Avenue in New York and a modern hotel on any "Main Street" are both first class in their respective communities, but could they both use the same standards of carpets, table linen, bed linen, etc.? No, and that is what makes the problem so difficult. As a matter of fact, it would seem that hotels will profit more by creating standards of their own in the selection of types and designs of the merchandise they use before taking up the subject of standardization at the source of manufacture.

Standardization of Kitchen Utensils

The modern hotel, using, as it does, almost every kind of merchandise manufactured, has before it a tremendous task to standardize what it buys and uses, and it would be an absolute impossibility to make any headway unless the manufacturers and jobbers handling the various kinds of merchandise are willing to create standards at their source. As an illustration: all hotels use roast pans in their kitchens, ranging in size from about 12 to 28 inches in length. There are many sizes between these two limits that could easily be dispensed with once the subject was given sufficient thought by the hotels' executives, which, of course, includes its chefs and others directly implicated in the use of such pans. In order to reduce the number of sizes of roast pans, it first becomes necessary to circularize the hotels throughout the

country with questionnaires, which questionnaires, when returned to a central point, have to be assorted with a view to securing a majority of opinions on particular sizes of pans. When this long drawn-out part of the work has been finished, it then becomes necessary to go to the manufacturer and discuss the subject with him. If he is one whose business is to supply hotels, he will see the importance of the request and go about the task of changing his machinery and dies so as to make only the sizes the hotels find it necessary to use. After the manufacturer, the jobber must be consulted, and so on to the ultimate user of the pans. When roast pans are mentioned, only one kitchen item has been considered, and when you know that there are upwards of 1200 different articles used in a modern hotel kitchen, nearly all of which will stand an effort at standardization, you will readily see that the problem has many ramifications.

FURNITURE OR ROOM EQUIPMENT

In leaving the kitchen of a hotel, we have the other departments to consider, and we can then take up the subject of furniture or room equipment. Every one knows what the room equipment of an ordinary hotel bedroom is, and when you begin to try to standardize each article of that equipment you have almost a life's work before you. However, the many angles connected with the subject only show its importance, and if in the ordinary course of events a half dozen items could be standardized in a year, then many millions of dollars will have been saved.

RESULTS OF STANDARDIZATION

To show what can be done by standardizing, the following fact may prove interesting: a large chain hotel in New York simplified its requirements and reduced the cost of items simplified 20 per cent below former cost, thereby releasing $350,000 from former inventories, and showed a saving of $100,000 per year. This was not the result of standardizing articles in manufacture, but was accomplished by reducing thirty styles of glassware to ten; fifteen designs of carpet to three; many patterns of table linen to one, and simplifying generally about two hundred other items. The foregoing is what was meant when it was stated earlier in this article that hotels might profit more by creating standards of their own in the selection of types and designs of merchandise, rather than concern themselves at present with standardization in manufacture.

Some years ago, the manufacturers were turning out over 175 types of lamp bases, which made it necessary to purchase a lamp that would fit the socket already installed. Through the simplification brought about the manufacturers are now turning out only six standard bases. There were also manufactured about three dozen different varieties of attachment plugs which were not interchangeable: through simplification the standard plug with the parallel blades resulted, the usefulness of which speaks for itself. Almost every kind of appliance on sale today is equipped with this standard plug. The result of these two simplifications is outstanding.

The work of the "Division of Simplified Practice" in Washington has been far reaching, and anyone interested in what has been done by the Department so far can secure booklets or pamphlets on the various subjects by applying to the "Division of Simplified Practice," Department of Commerce, Washington, and all who have any interest whatever in the subject will do well to learn the results of the Department's efforts.

WASTE ELIMINATION

The subject of Waste Elimination, which, of course, is part of the effort at standardization, has been one that has interested hotels for many years, but in a different way than is conveyed by the title of this article. Hotels have always saved grease derived from the operation of a kitchen. Grease is divided into several classes, such as clear and mixed, and is sold to the manufacturers of soap. Bones are sold and used, when ground, as fertilizer; waste paper is saved and baled, and sold to paper manufacturers. Swill, if in proper condition, and when free from broken glass and hard substances, is sold to the raisers of hogs and makes the best kind of food obtainable for that purpose.

Simplification and Standardization of Hospital Supplies

By Margaret Rogers

Chairman, Committee, Simplification and Standardization, American Hospital Association

As a result of what had been accomplished in other lines of industry, the American Hospital Association, some five years ago, became interested in the work of simplification and standardization of commodities purchased by hospitals. This work was carried on with the active coöperation and advice of the Division of Simplified Practice of the United States Department of Commerce.

Progress During World War

During the World War it was one of the major functions of the Conservation Division of the War Industry Board to concentrate its efforts for the release of the largest amount of labor, capital, materials and equipment for war purposes under the motto, "Maximum production at minimum expenditure." Simplification and standardization, therefore, in its broadest sense, played an important part in this war-time program, although its principles had been recognized before that time. These principles were applied with vigor by the Federal agencies in buying, manufacturing and selling with enormous saving of material, labor and capital.

Post-War Application

Many business organizations, after the war, decided to apply the same principles of simplification and standardization to normal peace conditions to test its value as a management policy. While progress was made by many concerns in this direction during the period of depression and reconstruction, 1919–1921, little impetus was given to the movement. It was during this period that the Federated American Engineering Society, of which Mr. Hoover was President, began making a study of six of the largest industries, namely: metal trades, boots and shoes, textiles, building, printing and men's ready made clothing. Late in 1921 the report of this survey was published under the title of "Waste in Industry." This report brought out the fact that in these six industries alone there existed a preventable waste of from 29 to 64 per cent and that ten billion dollars could be saved annually through simplification and standardization. The war experience followed by this report proved conclusively the urgent necessity of utilizing standardization in the elimination of unnecessary varieties and the concentration upon the manufacture and distribution of the articles of greatest interchangeability. Mr. Hoover, who had then become Secretary of Commerce, established the Division of Simplified Practice as one of the units in the general program of the Department of Commerce to eliminate industrial and commercial waste and as a fundamental means of promoting better business. The Division's activities are purely coöperative in character. The initiative must come from the business or industry. Its chief function is to serve as a centralizing agency in bringing together manufacturers, distributors and consumers of the specific commodities and to support the recommendations that they may mutually agree upon which will be of benefit to the industry and the public concerned. The Division of Simplified Practice works also in conjunction with the United States

Chamber of Commerce and the American Engineering Standards Committee. In the light of this information, the American Hospital Association felt that some of the same principles could be successfully applied to the hospital field. With the advice and coöperation of the Division of Simplified Practice, the Association decided to make a study of hospital beds, which might become a basis for developing similar investigations in other commodities.

STANDARDIZATION OF HOSPITAL BEDS

As a first undertaking, the Association, through its Committee on Simplification and Standardization, made a survey of the hospital field to determine the sizes and types of beds in use. A questionnaire was prepared requesting definite information as to the height, width, length, type and use, whether for private rooms or wards, also the number of beds, and information as to how many beds had been purchased during the previous three years. Definite instructions were given as to measurements. A similar questionnaire was prepared for the manufacturers requesting information as to the number of beds sold, sizes and types that were increasing in popularity, and what sizes and types could be eliminated with advantage. These questionnaires, together with a letter stating the object of the survey, were sent under date of July 12, 1923, to some 1100 hospitals in the United States and to ten manufacturers of hospital beds. The questionnaire did not enlist much interest at first. It was necessary to send out a second questionnaire before a sufficient number of replies were received. These replies were tabulated and analyzed, which showed the following results:

Total number of beds reported, 92,167.

Variety in lengths—33, as follows: 60, 64, 65, 68, 70, 70¼, 70½, 71, 72, 72½, 73, 73½, 73¾, 74, 74½, 75, 75½, 76, 76½, 77, 77½, 78, 78½, 79, 79½, 79¾, 80, 81, 82, 83, 84, 86, 90 inches.

REPORTED LENGTHS (in order of relative importance)

	Per Cent		Per Cent
72, 72½	27.5	73, 73½, 73¾	3.4
75, 75½	16.0	60 to 71 inclusive	1.0
74, 74½	14.5	80	.8
78, 78½	12.3	82 to 90 inclusive	.8
76, 76½	11.3	81	.6
77, 77½	11.2	79, 79½, 79¾	.5

PURCHASES

Length	Up to 1920 Inclusive	Since 1920	Change in Popularity
	Per Cent	Per Cent	
72	31.8	22.6	28 per cent decrease
74	16.6	6.8	69 per cent decrease
75	14.9	15.1	1 per cent increase
76	14.7	14.4	2 per cent decrease
77	.7	2.1	200 per cent increase
78	12.8	27.1	112 per cent increase

According to the preceding table, there was a decided tendency toward a longer bed than the 72-inch size, which was most popular previously. This trend was also noticeable in the 74-inch bed, and as the figures for the 75-inch beds showed little change, it seemed that the 78-inch size was coming rapidly into favor. The Federal Specifications Board had already adopted the 78-inch length, or inside distance between head and foot posts, as standard for all United States Government hospitals.

Variations in widths—34, as follows: 24, 27, 29, 29½, 30, 30½, 31, 31½, 32, 32½, 33, 33½, 34, 34½, 35, 35½, 36, 36½, 37, 37½, 38, 39, 39½, 40, 41, 41½, 42, 42½, 43, 44, 45, 46, 48, 54 inches.

ard, and that any other widths should be looked upon as special to meet special conditions. The 36-inch width of end angles of the spring has been adopted by the Federal Specifications Board for use in all United States Government hospitals.

Variations in height—44, as follows: 12½, 13, 13½, 14, 15, 16, 17, 18, 18½, 19, 19½, 20, 20½, 21, 22, 22¼, 22½, 22¾, 23, 23½, 24, 24½, 25, 25½, 25¾, 26, 26½, 27, 27½, 27¾, 28, 28½, 29, 29½, 30, 30½, 31, 31½, 32, 33, 34, 35, 36, 40 inches.

The height of 30 inches from floor to spring fabric, inclusive of wood shoes, adopted by the Federal Specifications Board as standard for all United States Government hospitals, was con-

REPORTED WIDTHS (in order of relative importance)

	Per Cent		Per Cent
36, 36½	66.3	34, 34½	1.1
29½, 30, 30½	16.6	38, 38½	.5
31, 31½	5.7	43 to 54, inclusive	.5
42, 42½	2.7	41, 41½	.3
39, 39½	2.3	40	.3
37, 37½	1.8	32	.2
35, 35½	1.4	24 to 29 inclusive	.2
		33, 33½	.1

PURCHASES

Width	Up to 1920 Inclusive	Since 1920	Change in Popularity
	Per Cent	Per Cent	
30	5.1	0.7	86 per cent decrease
31, 33	5.1	1.6	68 per cent decrease
36	69.4	82.7	19 per cent increase
39	3.4	6.8	100 per cent increase
42	5.0	3.4	32 per cent decrease

As regards the width, the 36-inch bed was by far the most popular, representing considerably over 50 per cent of the beds either before or since 1920. For this reason it was believed that this width could be made standsidered too high, and the 27-inch height was recommended as the standard height for general hospital use, believing that this height was more convenient for the majority of nurses. However, since rubber-tired casters

REPORTED HEIGHTS (in order of relative importance)

	Per Cent		Per Cent
24, 24½	33.0	18, 18½	3.3
26, 26½	12.7	22, 22¼, 22½, 22¾	2.9
29, 29½	10.2	30, 30½	2.0
27, 27½, 27¾	8.7	19, 19½	1.4
25, 25½, 25¾	7.1	32, 33, 34, 35, 36, 40	1.3
28, 28½	6.4	12½, 13, 13½, 14, 15, 16, 17	.9
20, 20½	5.1	31, 31½	.5
23, 23½	4.1	21	.4

PURCHASES

Height	Up to 1920 Inclusive	Since 1920	Change in Popularity
	Per Cent	Per Cent	
18, 21	8.4	4.8	43 per cent decrease
22, 23	5.5	9.6	75 per cent increase
24	20.2	10.8	46 per cent decrease
25	8.7	5.2	40 per cent decrease
26	21.9	22.7	4 per cent increase
27	13.7	20.8	52 per cent increase
28	11.1	11.7	5 per cent increase
29	3.4	.4	88 per cent decrease
30	2.1	8.4	320 per cent increase

and extension stems were widely used, permitting adjustment of height to suit the individual, agreement on a common height was not considered necessary at this time.

RESULTS OF SURVEY

The report of this survey was submitted to the Division of Simplified Practice with the request that a conference be held with manufacturers, jobbers, national hospital associations, state and sectional hospital associations and other users of hospital beds. Such a conference was called by the Department of Commerce at which the representatives from the various groups named considered the specific recommendations as above outlined. As an outcome of this conference, a 78-inch length, 36-inch width, and 27-inch height were adopted for recommendation as standard dimensions for adult hospital bed. These recommendations were submitted to the hospitals and to manufacturers, and were approved. In accordance with a unanimous action of the conference, the United States Department of Commerce, through its Bureau of Standards, recommended that simplified sizes and varieties of hospital beds be established as follows:

1. For general hospital use:

	Inches
(a) Length, inside distance between head and foot parts	78
(b) Width of end angles of springs	36
(c) Height from floor to top of springs, inclusive of casters, etc.	27

2. For certain institutional use the need for a narrower bed is recognized. In these cases the recommended width

is 33 inches, with dimensions the same as (a) and (c) in (1) above.

3. For private-room use, where a wider than standard bed is desired, the recommended width is 39 inches, with dimensions the same as (a) and (c) in (1) above.

These recommendations were approved by the Director of the Bureau of Standards and the Honorable Herbert Hoover, Secretary of Commerce, and became effective January 1, 1925, subject to regular annual resurvey and revision if necessary. (Simplified Practice Recommendation No. 24—Hospital Beds.) This eliminated 97 per cent of lengths, 91 per cent of widths, and 97½ per cent of heights and permitted interchangeability, economy and flexibility of service, and replacement in linens and mattresses as well as beds.

Before leaving the subject of hospital beds it might be well to state here that a resurvey of the hospital field was made a year and a half after these standard sizes had been adopted, inasmuch as the formulation of standards for use is a less important part of the procedure and the adoption and adherence is most vital to the success of any simplified program. This was done in the usual way by questionnaires to the hospitals and manufacturers. The replies to the questionnaires were received so promptly that they were tabulated, analyzed and completed in less than three months. This indicated a growing interest in the work of simplification and standardization by the hospital people. The result of this study indicated that there was 70 per cent adherence to the sizes adopted, and it was, therefore, felt unnecessary to make any changes at that time.

BED BLANKETS

The standardization of bed blankets had already been accomplished by the manufacturers of cotton, wool and cotton and wool-mixed blankets. The American Hospital Association coöperated in this work, and the Chairman of the Simplification Committee attended the meeting at which the number of sizes were reduced from 78 to 12, or an elimination of 85 per cent. Their recommendations were accepted by the American Hospital Association. (Simplified Practice Recommendation No. 11—Bed Blankets.)

HOSPITAL CHINAWARE

In the later part of the year 1924 and the year 1925 hospital chinaware was made the subject of study. This work was considerably simplified on account of what had already been accomplished by the American Hotel Association which, in coöperation with the American Vitrified China Manufacturing Association, had reduced the number of sizes of hotel chinaware from 700 to 192. The study was made in the same manner as with beds by questionnaires. In preparing the questionnaires we took advantage of what had already been done by the Hotel Association, eliminating a number of items on their list that did not particularly apply to the hospitals. The replies were analyzed and the result showed that 38 per cent of the hospitals accepted the original list as sent out, while 58 per cent indicated preference. The fact that 48 hospitals reporting, limited their requirements to 17 items was most significant. This report was submitted to the Department of Commerce. A conference was held with representatives from the pottery industries and other interested groups, at which a list of 115 items were adopted. These sizes were to be made in three weights as covered by the trade names, *rolled edge*, *medium weight* and *light weight*. These recommendations were accepted by the hospitals and manufacturers and became

effective July 1, 1925. (Simplified Practice Recommendation No. 40.)

That fewer items were necessary for hospital service was verified by representatives from two of the largest manufacturers of chinaware present at the conference, who stated that 78 per cent of their sales were concentrated on 42 items. These items are carried in stock and manufactured in four different patterns, and can be purchased at from 10 to 15 per cent less than the regular price. This means that if the hospital requirements could be supplied in these 42 items, the result would be reduced prices, smaller inventories, and no delay in filling orders. This list has been found ample for the requirements of many hospitals.

HOSPITAL AND INSTITUTIONAL TEXTILES

These were next made the subject of study, and it was done in the usual way, by questionnaire, the hospitals having become so much interested in the simplification and standardization program by this time that the questionnaires were returned promptly with the required information. The study indicated a large variety of sizes of the various commodities in use. A meeting was held with the manufacturers of cotton textiles and distributors, as well as representatives from the Hotel Association, Young Men's Christian Association, Young Women's Christian Association, Federation of Women's Clubs, and representatives from the various Government departments.

The following tables give the sizes found in use as well as the sizes recommended. These sizes have been submitted to the hospitals as well as other interested groups and were approved, and the schedule of sizes became effective October 1, 1927. (Simplified Practice Recommendation No. 74—Hospital and Institutional Textiles.)

PLUMBING FIXTURES

At the present time a study is being made of hospital plumbing fixtures. The manufacturers and distributors have coöperated with the American Hospital Association and the Department of Commerce in this study. The findings of this survey are ready to be presented to the hospitals. A similar study is being made by the manufacturers of surgical supplies, which includes gauze, crinoline, bandages, adhesive, etc., and it is hoped that the findings of these investigations will aid in the development of economies, improved methods and better materials.

STANDARDIZATION IN GERMANY

In connection with this it may be of interest to note that Germany made a comprehensive report of standardization work on bed linen, body linen and clothing used in hospitals as published in the Zeitschrift fuer das gesamte Krankenhauswesn, October 24, 1927, under "The Fachnormenausschuss Krankenhaus." (Committee on Branch Standards, Krankenhaus.) In this report Germany has made a complete effort to not only standardize the sizes of spreads, sheets, towels, pillow cases, blankets, aprons, gowns for patients (adults, children and infants), employees nurses and doctors, but also to standardize the qualities, weights, colors, etc., of the materials used.

Germany has already made a notable contribution in other hospital commodities such as beds for adults and children, elevators, etc. Their work in its thoroughness is a great step in advance of anything that has been accomplished in the hospitals in this country.

HOSPITALS, A GREAT NATIONAL INDUSTRY

Although hospitals began as charities for the poor, they have now grown to be

a daily necessity serving all classes of society. They constitute a great national industry. The capital invested in hospitals in this country is conservatively estimated at three and one-half billion dollars; this does not include endowments for hospitals. The annual expenditure for maintenance alone is placed at about one billion dollars. New hospital construction for the past few years amounts to about three hundred million dollars yearly. Furthermore, the magnitude of the hospital field expressed in terms of daily

SIZES OF TEXTILES FOR ADULT BEDS

Item	No sizes in Use	Sizes Adopted	Percentage of Elimination	Depth of Hem	Present Standard Packing (Per Case)
Bed pads	63	36 x 36 36 x 72 36 x 76	95	.....	.....
Pillow cases	47	42 x 36 45 x 36	95	3 inches	50 doz.
Sheets	50	63 x 99 63 x 108 72 x 99 72 x 108	92	Top: 3 inches Bottom: 1 inch	20 doz.
Draw sheets	70	45 x 72 54 x 72	97	Top: 1 inch Bottom: 1 inch	20 doz.
Spreads	54	63 x 90 72 x 90	96	¾ inch	50 & 100
Bureau scarfs	49	18 x 45 18″ wide by bolt	96	.....	5 doz.
Towels (bath)	42	18 x 36 22 x 44	95	.....	50 doz. 50 & 25 doz.
Towels:					
Face	31	14 x 20	96	.....	200 doz.
Hand	48	16 x 32 18 x 36 18″ wide by bolt			100 doz. 100 doz. 40/50 yds. per piece 2000 yds. per case

SIZES OF TEXTILES FOR CRIBS AND BASSINETS

Item	No sizes in Use	Sizes Adopted	Percentage of Elimination	Present Standard Packing (Per Case)
Sheets:				
Crib	17	45 x 64–54 x 90	88	20 doz.
Bassinet	10	36″ wide sheeting by bolt		
Spreads:				
Crib	19	45 x 60–54 x 90	89	50 & 100
Bed pads:				
Crib	14	18 x 18	93	
Bassinet	14	18 x 18	91	

population and expenditure is a surprise even to those closely connected and intimately familiar with the hospitals of this country. Over one million, two hundred and fifty thousand people must be housed, fed and cared for each day, representing an expenditure of three million dollars each day.

Those engaged in hospital work understand how difficult it is to obtain the funds to carry on hospital activities. The great progress made in medical science has in turn necessitated a constant expenditure on the part of the hospitals for scientific equipment and investigation. When one considers that hospitals dealing with similar types of cases are seeking the same objectives wherever located, it seems logical for the hospital executives to consider not only the methods of gaining those objectives, but also the ways and means of standardizing the material and supplies used in so doing. There seems to be little hope of securing any marked reduction in hospital costs in the future, unless at the expense of efficiency, except by elimination of waste through simplification and standardization of supplies and equipment. This affords an avenue of economy that has scarcely been approached, compared to its possibilities.

Standards and Specifications from the Standpoint of the Ultimate Consumer

By F. J. Schlink
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ACCEPTED usage among economists confines the application of the term "consumer" to those individuals who, collectively, make up the total population engaged in the purchase and use of "end consumption goods." And by the term end consumption goods we mean all goods bought to satisfy personal and family needs and wants, whether necessities or luxuries. On the other hand, goods bought to be used again for purposes of pecuniary gain are not classified as end consumption or consumer's goods.

Thus all goods bought by manufacturing establishments for the purpose of furthering the process of producing goods to be sold on the market are not consumption goods, and the manufacturers are not consumers. In a technical sense goods in the hands of the retailer are consumption goods only when they reach the consumer. To the retailer they represent tied-up capital, and through sale are expected to return a profit.

Who Is the Consumer?

In this article the term "consumer" will be applied only to those who purchase goods for their own or family use, and not to manufacturers or distributors who purchase goods in a finished or semi-finished state in order to effect a resale for profit. Consumption goods will mean those goods which are generally utilized by the "consumer" for consumer's purposes. By so using these terms it will be possible to avoid the use of the terms "end consumption goods" and "ultimate consumer."

Consumers so defined, then, include the total population when engaged in the acts of buying or utilizing goods or services without the object of making money out of their use. Consumers include all classes and races, employed and unemployed, capitalists and laborers. The fact that there are many borderline cases in which it is not possible to determine whether one is acting as a consumer or a producer need not obscure the fact that an essential difference does exist.

Taken in the aggregate the amount of consumable goods bought and used in any given territory is a function of the distribution of purchasing power, the habits of saving of the community and the total quantum of goods produced per capita. The first two of these factors are essentially a product of the habits, customs, legal codes, conventions, and mores of the people. Standardization, as the term is coming to be currently used, is almost purely a technological datum. To the extent that standardization in field, factory and workshop may stabilize employment, it may in some small way affect the distribution of purchasing power, though for the most part this is dependent upon other factors. Likewise, to the extent that it may result in mass

production with lower prices, it may affect the second factor—the savings of the community. But standardization, if given free rein in the productive process, will result for the most part in mass production, increased industrial efficiency (more output of goods with less "input" of time, effort and materials) and will vitally affect the third factor above—the total quantum of goods produced per capita.

It is not necessary to establish here the fact of savings in time, effort and materials possible under standardized conditions in industry. Much controversy exists on that head, but the view is rather generally accepted that the "savings" are material even after due allowance is made for all antithetical factors including a certain restraining influence upon technical development which may possibly be inherent in standardization itself.

Unimpeded by other considerations of a pecuniary or conventional sort, the net result of extending the standardization technique would be a decided increase in the goods and services flowing from the more carefully articulated, more efficient industrial process. Continuing to disregard all the complicating factors, it would follow that the per capita consumption would rise because per capita output would rise. But the modern community is not organized as a body of people working coöperatively to increase the flow of goods without increased labor, on the one hand, and on the other, consuming those goods. The institution of private property and the factors determining conventional distribution of money income produces a situation where what is gain to one is not necessarily nor as a matter of course gain to another. If standardization, under our non-coöperative economic organization, results in increasing industrial efficiency, the benefits flowing from the increased efficiency go first of all, in the nature of things, to the owners of the industrial equipment. Benefits to the ultimate consumer must of necessity, therefore, be secondary, and come through whatever there may be of competition, or of such competition as results in better quality and lower prices.

WHAT FACTORS IMPEDE THE FLOW OF BENEFITS TO THE CONSUMER

Standardization of the sort that is carried on for the benefit of manufacturing economy is a natural development and one that requires little coaxing except in trades wherein the science and technique underlying design and production are at a low stage of development. On the other hand, that type of standardization which has its greatest value in savings that will accrue to the ultimate consumer is a tender plant and needs a great deal of nurture. In the one case, standardization of methods, materials and processes makes for manufacturing economies and these economies will quite naturally in due course be reflected in profits. In the other case, where standardization is conducted primarily for the economy and better service of the consumer, there remains the additional long and difficult process of convincing the potential purchaser of the goods that a truly better and cheaper product is available for his use. The odds against effectively carrying any such assurance to the consumer in a welter of competitive advertising can well be overwhelming. And when the entrepreneur contemplates further the great amount of effort it will require to break down the resistance not only of the customer, but of dealers who have a compelling financial interest in pushing goods which offer a longer margin of profit or which sell more readily on account of established reputation, it can readily be understood why he may

be deterred from taking the difficult path of consumer education or re-education. This is probably in large part the reason why the production of consumption goods has been less touched by standardization and also why when the methods of production of these goods are standardized, the economies tend to flow into increased profits. In other words, competition cannot safely be relied on to encourage standards of design and quality in the production of consumption goods in the first place nor to carry to the consumer the benefits of standardization in the second.

A good example of this failure of competition to react in the consumer's favor may be found in the varnish industry. The Government, through the operation of specifications, a few years ago reduced the price it paid for varnish from $4.40 a gallon to less than 80 cents. It would have seemed quite logical for at least one manufacturer to have adopted the new technique in manufacture and lowered his price correspondingly to the retail trade. But, on the other hand, he would be promptly accused of unbusinesslike practices, or of cut-throat tactics, and the consumer, assuming that the low-priced product was very likely inferior, would confidently select the high-priced one. It is easy to see why a cautious business man prefers to conduct business according to the old methods, or, if he changes his methods of production, to let the savings slip quietly into profits or dividends.

Frequently new methods of production promising significant economies to consumers, and standards of performance or quality are installed, not upon the initiative of the trade itself or any important member of it, but because some large, exceptionally well-informed and technically well-staffed consumer such as the Government is determined to bring about price and quality competition on a new plane. The work of such consumers is not widely heralded and has no sensible influence upon the market resorted to by individual consumers, so that in this case, as in hundreds of equal or greater importance, no significant reflex of the splendid technical work of the Bureau of Standards and other federal technical services is felt by the trade concerned, in its dealings with the general public. Thus it is that an inferior varnish made under the old rules is still selling briskly at around $7.00 a gallon and there is no great likelihood that any large producer will offer the ultimate consumer the fine Government grade varnish at a reasonable retail figure of, say, $1.20 a gallon.

In grease spot removers or clothes cleaning fluids, we have a clear example of how mass production combined with the typical intensive and competitive selling over a period of many years, fails to bring down the retail price to anywhere near the cost of preparation plus a "reasonable profit." A whole family of these products are gasoline or carbon tetrachloride, and 5 cents to twelve cents a pound would allow a 50 per cent markup on quantity costs of the more expensive of the two types. We are forced to pay, however, from 60 cents to 90 cents a pound for these simple materials, and about the same for the gasoline as for the tetrachloride, though the wholesale cost of gasoline is only a fraction of that of the other liquid.

In pointing out the difficulties in the way of consumer's benefiting from standardization, we do not fail to appreciate the fact that our present-day civilization is based on machine production and standardization. The telephone, duplicated to the extent of twenty million substantially identical sets, is a commonplace illustration. Radio sets of which there are said to be now nearly eight million owners, abso-

lutely dependent upon standardized electrical and mechanical relationships between component and related parts is another suggestive illustration. We are all aware that in a world of custom-made goods, only those having very high incomes could possibly possess the goods which are the commonplace of low income groups under mass production. But it is only too evident that this evolution toward the cheap reproduction of goods is very slow, imperfect, and, in many cases, non-existent. The illustration already adduced of the commonplace chemical carbon-tetrachloride and gasoline as a cleaning fluid, being sold at custom-made prices, although a mass produced article, is a sufficient evidence of this, and hundreds of such cases could be cited.

INTERESTED ORGANIZATIONS

What agencies are working in behalf of the ultimate consumer? There are first and foremost the Government bureaus operating in that narrow territory where interesting or useful information can be given without mentioning trade names. With erudition and in minute detail we are told how carburetors can be tested for performance, but are given no results of any of the thousands of tests that have been made, in terms that will enable us to buy the right carburetor for our car. These Government bureaus possess a great deal of relevant and useful information on practically all commodities bought on the market for current consumption. The free distribution of this information would make available to a large number of consumers, significant data aiding in the selection of goods. A more detailed discussion of the work of these organizations is to be found in another article in this issue.[1]

Of all the activities that work in the consumer's interest, that of the American Medical Association in the field of patent medicines and of prepared "ethical remedies" seems the most deserving of propagation. This service, necessary in the main only because certain federal services within the same professional field (public health, pharmacology, chemistry, etc.) are concerned basically with the narrow problems of the Government itself as a business concern or a law enforcing agency, or with that limited scope of recommendations which are not readily reducible to brand or makers names and varieties, is distinguished among all for its fearlessness and for the usable concreteness of its findings, and their effectiveness in guiding physicians in prescribing, or the laity in purchasing, what remain of *bona fide* drugs in the modern drug store.

Such organizations as the National Retail Dry Goods Association, the American Gas Association and the National Electric Light Association, as associations of business men, are engaged in a type of activity which gives them a major interest in standardization of consumption goods. The American Gas Association has a vested interest in safe, standard, efficient gas ranges and other gas-using equipment, as a factor in competing with coal and oil furnaces, and electric ranges and equipment. An analogous situation exists with respect to the National Electric Light Association. In both cases there is a direct interest in the original product, and in the certainty that the same will be utilized in the purchase of current services. The American Gas Association has in operation an excellently planned, equipped and staffed testing laboratory.

The National Retail Dry Goods Association is to set up a national laboratory for the purpose of intelligently and scientifically testing and selecting goods for sale by department

[1] Brady, page 247.

stores. Such work, if well and wisely administered in behalf of the stores' customers and with the coöperation of technical experts having an interest in the needs of the consumer, along the lines of the policy adopted by the American Gas Association in administering its laboratory, can have an incalculable effect on an enormous number of kinds of goods, and it seems probable that the greatest aid to consumers in realizing the benefits of standardization and mass production fully and quickly will come through some such organization. One of the great mail order houses, also, has already laid the basis of such a laboratory.

An embryonic activity also exists in a so-called Consumers' Club, set up as a kind of information bureau and clearing house, to supply confidential information to its members, who are charged a small sum annually for membership, and receive a list giving information about particular goods under brand name, one part being a listing of goods that can be recommended because of their good quality or economy or both, and another part being devoted after the manner of the American Medical Association's listings, to those articles, which on account of poor value for the money asked, or fraudulent or misleading advertising, or other reasons, seem not deserving of recommendation. If the findings of the Bureau of Chemistry, the Bureau of Standards, and of a half dozen private corporation laboratories were available to the compilers of this list, its service to its members would be very great; as the matter now stands, it is a very imperfect experiment to bring information of limited extent and necessarily varying reliability to the aid of the ultimate consumer. Its excuse for existence is that, broadly speaking, no other helping hand is yet offered that enables a layman to translate technical knowledge and specifications for merchandise into economical purchases at the corner store.

While the engineering societies are, almost without exception, occupied with the problems of manufacturers, the American Engineering Standards Committee has recently made a beginning on projects in consumer goods by calling conferences on standard specifications for bed sheets and refrigerators. The American Home Economics Association is rapidly awakening to the need of putting engineering science to work in the solution of problems of the household and are asking for simplification and standardization. They are considering the establishment of a testing laboratory to investigate consumers' goods. This association through its contact with millions of housewives and young women later to be housewives, through the educational activities of its members (who are mainly teachers of domestic science in high schools and colleges), may very likely be the most important agency through which a knowledge of the technique of goods selection and of standards and specifications will be brought to the ultimate consumer.

There is also a tendency toward the development of a new economy—the economics of consumption—a discipline which will in time bring about new concepts of the relation of industry to the consumer, and tend to the turning of industrial production to a maximum of service and utility in fields other than aesthetic.

The enormous expenditure on advertising, which is approaching a total of two billion dollars a year, is a potential agency of consumer education incalculably greater than all others. It does not, however, seem likely, and one is able to judge of this pretty safely following a careful study of the practices recorded in the current flow of maga-

zine, newspaper and billboard advertising, and the views of advertising experts themselves set forth extensively in their special trade journals, that any large proportion of this expenditure will be turned to the consumer's advantage in the measurably near future. It is conceivable, of course, that consumer organizations, such as that typified by the commodity list already referred to, may in time enter the field of advertising as a means of bringing their activities and findings to the attention of the general public, in competition as it were with the sales-making efforts of businesslike advertisers. All these things, however, lie in the future.

The most likely effort that can result in immediate gains for large numbers of the population is one toward a release of data by governmental agencies, including the bureaus of the Federal Government, various technical services of state and city governments, and the state and municipal universities and endowed educational institutions. The latter particularly represent the largest reservoir of goods knowledge and of test and specification techniques outside the Government services, which can, if there be sufficient call therefor, be rapidly extended in the direction of providing information effectively applicable in laymen's purchasing.

WHERE STANDARDS ARE NEEDED

To whichever organization or group of organizations falls the task of aiding the consumer by forcing standards of quality and performance, and through the process of mass production, lower price, there is no difficulty in finding plenty of things to be done. Needless diversity, for instance, in the components of such commonplace devices as sewing machines and typewriters makes it impossible (often through the intent of the manufacturer) to interchange parts such as screws and the common fitments, or even necessary supplies such as needles and ribbons. Lack of standards in these obvious and essential features brings a heavy cost. If standards were established and guaranteed for such things as ease of running, accessibility of parts for repair, durability, noiselessness and many other items, it is safe enough to say that the typewriter would be a much more developed and a much cheaper instrument than it is now. Witness the extraordinary circumstance of the incandescent lamp, whose quality has improved consistently since its first commercial production and which now with eight price reductions since 1920, sells at 44 per cent below 1914 prices, although the cost of goods generally is 65 per cent above the pre-war level. Excellent fountain pen ink can be produced under specifications at a factory cost of only a trifle over that of bottled drinking water as delivered to New York office buildings. Yet in two-ounce bottles it brings a price of ten or fifteen cents. The prime cost of some such commodities, including many kinds of lubricating oil, furniture polish, soap, cosmetics, and the like, is so low that costs of cans, jars, bottles, advertising and transportation are preponderant factors in the total cost of production and distribution. Yet, broadly speaking, no attempt has been made to put such goods upon a basis of local or regional manufacture and sale on an economical basis.

In the household the number of things to be done is legion, not only as to safe standards of quality of bulk goods as a cheap and effective substitute for a diversity of branded and over-embellished package merchandise, but standards of dimension to produce interchangeability (kitchen utensils, vacuum cleaner fittings).

Another important field is that of

providing technical formulae for common materials, much after the fashion of the standard technical recipe books such as those of Henley and the Scientific American, but adding the very important assurance that each formula is tested and known to be among the best, with due consideration both to proper functioning and to economy. This is a job of standardization of major importance, and is well typified by the Government's recent standardization of the Navy's formula for furniture polish, which, like many other household chemical products, is cheap and simple to produce, so that ingredients are simply purchased separately and poured together in a bottle or can by the department making use of it. The ultimate consumer's lack of the simple knowledge crystallized in this formula costs him many millions of dollars per annum in the aggregate, and the finishes on his furniture lack a great deal of being so well cared for. Such formulae should also indicate the cost of the ingredients exclusive of compounding, so that a person referring to such data may know the reasonable price range for the commercially compounded commodity. Such information has always had the effect of producing price competition in goods where competition has not hitherto existed. Very large declines in the selling price of such commonplace goods as lubricants, shoe polish, tooth paste and the like, may be expected as soon as the public in considerable number have access to information as to their incredibly low manufacturing cost, or even of the quantity cost of their ingredients.

Brief mention may be made of two other kinds of standardization that are needed to protect the consumer. One of these is standard trade practices. What does a guarantee by an automobile salesman mean in tangible terms capable of enforcement, when your brakes give out in three months after purchase of a car? If your fountain pen goes bad and you have a twenty-five-year guarantee, but the particular thing that goes wrong is adjudged by the dealer to be outside the meaning of the guarantee, who is to adjudicate the issue? In every such field standard practices should be established not merely by the trade concerned in the production and sale of the goods, but with the full public participation of those who pay for them. (A battery manufacturer once refused one of the authors replacement on an admittedly defective battery because it happened to have been bought at a cut-price retail store.) Reasonable and acceptable trade customs, if recorded in a form easily referred to and conveniently available, in shops dealing in the goods in question, would be very different from what they are under unrestricted evolution. As it is, the seller has all the power of decision, and the buyer, unorganized, comes to regard himself as quite defenseless against the seller's dicta.

Another important field of standardization is in quality of service. In the light and power field, fortunately, the sense of craftsmanship among the engineers is upon so sound and scientific a basis that the maintenance of voltage and frequency upon customers' lines is commonly carried out with astonishing precision, even better perhaps than the customer would insist upon if his opinion were asked. In many other utilities exactly the reverse is true. To cite but one of thousands of types of service for which the consumer lacks any recognized standards,—what provision is there for remission of special delivery or air mail charges when a letter bearing the special stamp takes longer in delivery than it would have taken in regular mail? Is

it not obvious that "back-stamping" of mail to show its time of transmission, as was once the practice, would either shorten the time of transit or dispel the public's illusions about the margin of time which is said to exist and which is paid for at a high rate? Has anyone ever succeeded in collecting for a day's unwarranted delay in the delivery of a telegram or express package? On the other hand, is not the charge made for the telegram or the package mainly based upon the factor of speed of service? Public utility commissions should establish standards of good practice in every common kind of public service, and the adjustment of costs for failure to deliver should be as simple and direct as the habitually prompt and decisive collection for the service in the first instance. If the lighting company consistently ran our supply voltage, say 5 per cent above normal, it would cost us 100 per cent above the normal figure for lamp renewals. Five per cent below normal would cost 10 per cent in illuminating efficiency or 17 per cent in available illumination, of all of which 99 out of 100 consumers are blissfully unconscious, and can afford to be so in larger cities only, because, in the main, the engineering side of lighting service is competently conducted. Yet losses of far greater magnitude occur to every one in respect to service in which the element of rationally and socially predetermined performance has not extensively entered—for example, the frequency of trains in a subway system, the answering time on telephone calls, and adequate pressure, continuous service, and freedom from pollution, in water supply.

In a population composed of individuals possessed of the physical and sociological variations normal to humankind, there is an evident limit to the application of standardization, and the full gamut of its technical possibilities cannot be permitted to be realized. It is inconceivable that a population, except of robots, would tolerate being clothed alike, fed alike, or housed alike at any given time unless under the rigors of military command. Some place between this picture, which some horrified persons view as the outcome of any form or method of standardization, and the irrational and chaotic conditions that now obtain, the habits and conventions of the people will draw the line, "thus far and no further."

The advertisers, for the most part, are committed to a program which will standardize the habit of demanding their own particular types, kinds, or varieties of commodities.

This is the new competition that, in the view of eminent industrial statesmen, supplants the old kind, on price at a quality, or quality at a price, as the life of trade.

If an intolerable increase in the pyramiding of intangible values is to be prevented, it is evident that the consumer must decide when and where he or she desires low-priced, efficient, uniform, mass-produced goods of relatively invariable performance, and when high-priced intangibles and "differences"—uniqueness of the sorts that make the consumer willing to forego estimates of useful and measurable values.

At any given time and with any given set of customs it is possible to draw a fairly clear line acceptable to the great majority of the members of the community alike, between commodities that serve one or the other purpose and are controlled by one or the other mode of determining the price.

Types of consumable goods, whose use is in the main a matter of simple habit, are taken as matters of course and do not enter in any significant way as factors in the maintenance of one's

social prestige, or in the satisfaction of aesthetic taste and appreciation. Such goods permit of standardization on a large scale: kitchen utensils and other household, office, and farm implements, appliances and supplies, timepieces, incandescent lamps, the working tools of the crafts and the professions, and thousands of other goods. Pictures, certain kinds of household furniture, a part of our clothing, personal accoutrements of various sorts, etc., on the other hand, fall into the class of goods commonly regarded as unstandardizable except as to minor or latent or constructional details or constituents (as the kind and quality of fiber, dye and sewing thread used in an opera cloak). Nevertheless, even here the quantities of goods produced in any given kind are so great as to permit of many, and sometimes substantially all, of the economies of mass production. A much wider standardization exists already in goods subject to the whims and caprices of the individual than is currently believed to be the case. Men's clothing (formal and informal, civil and military, ordinary and official, lay and ecclesiastic); women's silk stockings; automobiles; cigarettes and cigarette lighters; fountain pens; reproductions of famous paintings; school curriculums; wedding ceremonies, and funerals; are cases in point.

There seems little reason to fear that when consumers desire and are willing to pay for variety and uniqueness, standardization will be entered into in cases where sameness and monotony in goods would be the expected result; or as a corollary that standardization adopted for the sake of reduction of costs and widening of distribution, will be extended to those characteristics of the goods (color, odor, luster, richness of texture, nicety of workmanship) which afford significant aesthetic values —*provided the participation of the consumer in the initiation and development of the standardization is guaranteed*—as through the intervention and participation of some representative and responsible body. Such standardization as has brought about a loss of individuality and aesthetic values is the result, not of conscious efforts to achieve economy and wide distribution of goods, but of competitive businesslike efforts put forth in the interest of increasing profits, or the omnipresent human tendency to do whatever others are doing in considerable numbers,—whether that be solving cross word puzzles, or wearing stiff starched collars.

Certification Plan and Labeling System*

Methods for Broadening the Field of Supply of Commodities Covered by Nationally-Recognized Specifications, and for Increasing the Market for These Commodities

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IT is believed that many of your readers will find some items of interest to them in the outline given below of the so-called "certification plan," which is being applied to certain selected United States Government master specifications chiefly for the benefit of the Federal Government purchasing agencies and other public purchasers.

Preparation of U. S. Government Master Specifications

Before giving a description of this plan and telling something of the results now being obtained from its application, it seems well to call attention to the conditions under which the United States Government master specifications are prepared, and to their real commercial significance.

Prior to the organization of the Federal Specifications Board in 1921 each department and establishment of the Government had its own specifications for all materials purchased by it, the specification requirements being often in conflict with each other and seldom in conformity with commercial practice. To avoid duplication of effort in the procurement of material and to insure better utilization of our resources and industries, the Board was given the duty of not only compiling and adopting standard specifications but also of bringing them into harmony with the best commercial practice wherever conditions permit, bearing in mind the broadening of the field of supply.

Each United States Government master specification promulgated by the Federal Specifications Board is formulated by a technical committee consisting of official representatives of every department and establishment interested in the commodities covered by the specification. Full consideration is given by the technical committee to such advice as can be obtained from interested commercial and industrial concerns. The specification thus prepared by the technical committee is submitted formally to all departments and establishments of the Government and informally to various interested engineering and technical societies through the American Engineering Standards Committee. All criticisms received are given consideration by the technical committee in placing the specification in final form for promulgation by the Board for the mandatory use of the Government departments and establishments in the purchase of material covered by the specification.

It will be understood, therefore, that the United States Government master specifications represent a most serious effort to cover by means of specifications commercially satisfactory commodities for use by the Government in its own purchases. Considered as a whole, the 551 specifications formulated

* Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

by the Federal Specifications Board are probably the best group of commodity specifications thus far compiled. Many of them are far from perfect, but all of them are kept constantly under consideration for revision.

REVISING AND BROADENING THE FIELD OF SUPPLY

To the provisions made for revising the specifications and bringing them into harmony with commercial practice in order to broaden the field of supply can be attributed much of the value of the specifications to Federal Government purchasing agencies and other public purchasers and interested organizations. It is fully realized that the specifications must be subject at all times to revision as the state of the art of production improves, as the quality of raw materials available for a given product changes, and as new limitations are imposed on the use of a product. That these conditions have been given serious consideration, and that they exert a controlling influence on the United States Government master specifications, is shown by the fact that more than 20 per cent of the specifications have already been revised from one to four times since their initial promulgation. Not one of the current specifications has been in its present form for more than six years.

An effective first step in the broadening of the field of supply of commodities covered by United States Government master specifications is taken in the compilation of complete lists of firms manufacturing the general types of commodities which are the subject of these specifications. In compiling such lists use is made of all available governmental and non-governmental sources of information concerning the manufacturing firms, and this information is checked by direct correspondence with the individual firms. To obtain a list of firms of definite use in connection with any selected specification, there are omitted from the complete list such manufacturers as do not build commodities in accordance with the designated specification, and from the smaller list are omitted the names of such manufacturers as have not as yet expressed their desire to obtain contracts based on the chosen specification and their willingness to certify to the purchaser, when requested to do so, that the commodities delivered under contracts based on this specification do actually comply therewith.

Some idea of the value attached to the lists of "willing-to-certify" manufacturers by such officers of the Federal Government as are directly concerned with the Government departments and establishments as consumers (not as lawmakers) can be gained from the fact that the details involved in compiling these lists have been worked out in full accord with the ideas expressed by the Director of the Bureau of the Budget, and the lists are being distributed to all Federal Government departments and establishments at the suggestion of the Chief Coördinator.

Purchasing agencies of all of the Government departments and establishments, wherever their headquarters may be located, are making effective use of the "willing-to-certify" lists of manufacturers. As showing the attitude of these officers, reference may well be had to statements made by the Paymaster General of the Navy concerning the use of these lists, and the action taken by officers of the War Department in distributing the lists, as follows:

Navy Department

It is believed that the data contained in a list of "willing-to-certify" manufacturers would be of great value in building up a mailing list of primary sources of supply who

are known to be familiar with the requirements of certain well-known specifications and willing to comply with them.

The Navy will be glad to take steps to list any firm which has certified its willingness to guarantee that its product will meet a specification of the Federal Specifications Board or a Navy specification, and invite bids from such a firm when in the market. Proposal blanks issued by the Navy contain either the specification printed in full or a reference thereto; and an unqualified bid is assumed to be in strict accordance with the specification and subject to the tests and inspection outlined therein. In this connection, it will be appreciated if lists might be furnished showing names and addresses of firms which have certified their willingness to guarantee that the technical requirements of their product meet the specifications of the Federal Specifications Board.

It is believed that manufacturers will be quick to recognize the potential advertising value of a statement in their sales literature and advertising to the effect that their material is guaranteed to conform to certain well-known specifications.

War Department

In time of war it is very desirable that the Government be able to obtain the articles which it requires in quantity. A more general acceptance of the carefully prepared Federal specifications by general purchasing officers of industry will do much to accomplish this end. Education along these lines is necessary.

To spread the information concerning the specifications and the certification plan, I believe we could do much to further the scheme. The country has been divided into fourteen procurement districts in connection with industrial war planning. All together the Army has established fifty district procurement offices. In each of these districts the regular Army representative is in close touch with many reserve officers who would be mobilized in time of war for procurement duty. In time of peace these men are engaged in widely varying businesses, many of whom are purchasing agencies.

It is proposed, therefore, to send a letter to the Chiefs of all Supply Branches directing the attention of the regular Army executives of the procurement districts to the "certification plan" and the "sources of supply of commodities covered by United States Government master specifications," and to the belief that a more general acceptance of the Federal specifications by industry, particularly by manufacturers and large users, will do much to facilitate the procurement of suitable articles in time of war. The Federal specifications which are the subject of these studies have received the approval of the War Department after the most careful consideration. They are now mandatory upon the Army. Hence, the more generally they are accepted by industry the easier will be the task of buying under them in peace and in time of war.

A recent analysis of the distribution of the lists of "willing-to-certify" manufacturers shows that 75 per cent of the lists distributed have been sent to public purchasers—purchasers buying with the money collected from the public in the form of taxes. Five-sixths of these purchasers are officers of the Federal Government located in all sections of the United States.

APPLICATION OF PLAN

In applying the "certification plan" to the United States Government master specifications, serious consideration is given to the exact status of each specification. Selection is being made first of such of the specifications as are believed to be most nearly thoroughly satisfactory in their present form. Nearly 200 specifications have already been selected for this purpose, and lists of "willing-to-certify" manufacturers of commodities covered by 146 of these specifications have been compiled and distributed in mimeograph form, including 23 relating to bituminous roofing, waterproofing, and paving materials.

A resolution adopted by the trade association representing the industry concerned with these last-mentioned

specifications is of some interest in this connection. This resolution, which was worded to accompany a complete list of the members of the association, is reproduced herewith:

The following manufacturers, comprising the entire membership of the Asphalt Shingle and Roofing Association, unanimously signify their willingness to certify to the purchaser that the commodities supplied by them under the Federal Government Master Specifications, have been tested and found to comply with these specifications.

When the plans for compiling lists of "willing-to-certify" manufacturers were first formulated, more than 1000 outlines thereof were sent to public purchasers and to the officers of technical societies and trade associations having national recognition. The replies showed that the plans would be fully endorsed by consumer organizations, and that the only opposition to the "certification plan" as such (rather than to certain selected specifications to which it might be applied) would come from such organizations as are not truly in favor of real effective standardization.

It was to be expected that technical societies familiar with the formulation of specifications would be in favor of the plan. Correspondence brought to light the fact that many trade associations that might have been assumed to be opposed to the plan, at least initially, were actually very favorably inclined toward it.

PROMOTION AND EXPANSION

Many of the progressive trade associations are promoting the use of specifications in numerous ways. Lines along which these activities might well be expanded are as follows:

(a) First of all is publicity by means of which the industry is made acquainted with the real significance of the specification method of buying and selling.

(b) Second, but of no less importance than the first, is thorough coöperation in the preparation of specifications that can most properly be referred to as nationally recognized.

(c) Next is coöperation in the undertaking by inducing all of the members of the association to have their names included in the list of manufacturers willing to certify to the purchaser that the commodities supplied by them under nationally-recognized specifications have been tested and found to comply with these specifications.

(d) Trade associations representing either dealers or manufacturers reaching consumers through retailers can be of much help in showing the dealers and retailers how they (as both purchasers and sellers) will benefit from the plan, especially when accompanied by an effective labeling system.

(e) A final step for the trade association to take, *when the time seems ripe for it to do so*, is to make sure that its members are keeping faith so far as the certification and labeling are concerned.

Many agencies carrying on activities somewhat similar to those involved in the certification plan for promoting the use of nationally-recognized specifications, including not only the more progressive of the trade associations, but also inspection bureaus, testing establishments, and guarantee labeling organizations, are rendering valuable services to buyers and sellers at the present time.

It is not to be assumed that all trade associations and all manufacturers are enthusiastically advocating the certification plan. For various reasons certain manufacturers would prefer not to have the certification plan applied to commodities sold by them. It is noteworthy in this connection that practically all of these same manufac-

turers strongly advocate specifications for the materials purchased by them. The fact is that in no case has there not been a considerable number of thoroughly responsible manufacturers anxious to have their names listed among the "willing-to-certify" manufacturers of commodities covered by United States Government master specifications.

Special efforts are being exerted to prevent any misunderstanding on the part of either the manufacturers or the users of the exact significance of the lists of "willing-to-certify" manufacturers. The certificates which the manufacturers state they are willing to issue upon request are to be addressed to the purchaser and not to the Bureau of Standards.

CHECKING AGENCIES

It is expected that adequate "checking agencies" will be developed to prevent the abuse by irresponsible manufacturers of the opportunity to be listed as "willing-to-certify" although unable to "deliver the goods."

A manufacturer who places on record the statement that his commodity complies with a United States Government master specification is shortly made to realize that both his customers and his competitors are vitally interested therein and will check the accuracy of the statement and take such steps as may seem necessary or desirable to prevent any manufacturer from "obtaining business under false pretenses." The process of checking the accuracy of statements of this kind made by competing manufacturers is essential for the protection of the manufacturers themselves as well as the consumers. Both trade associations and better business bureaus have shown themselves to be vitally interested in this subject. By serving as an agency through which the various manufacturers keep watch on their competitors, trade associations can become very active in backing up the certification plan. Non-governmental organizations making use of nationally-recognized specifications can properly render such a service as this, but it would seem unwise for the Federal Government to do so—that is, beyond its own needs as a consumer.

In 1923 President Barnes of the Chamber of Commerce of the United States of America, in discussing the voluntary adoption of standards of quality, said: "In lines of merchandise where conditions warrant the adoption by representative trade associations of certain definite standards of quality or performance, the associations can hold to account any member failing to make delivery up to the standards adopted, and incorporated in sales contracts. Disputes arising in connection with such transactions readily lend themselves to settlement by the parties themselves, or by commercial arbitration."

In any event, the certificates issued by or on behalf of the manufacturer will be given weight according to the reputation for accuracy and reliability of the manufacturer or certifying agency. Manufacturers, certifying agencies, and consumers, all will have need for increased testing and inspection services. For the purpose of meeting this need and facilitating to the maximum possible extent the use of specifications, the National Bureau of Standards has compiled a thoroughly classified list of the laboratories throughout the country that are prepared to test various kinds of commodities to determine whether or not they comply with purchase specifications

MISCELLANEOUS

Reference has been made above specifically to United States Govern-

ment master specifications, as the manufacturers referred to herein are those willing to certify to compliance with these specifications. However, the plan outlined could readily be, and is being applied to other groups of nationally-recognized specifications. It is to be expected that the widespread application of the plan will be of benefit not only in the general promotion of the use of specifications by both the small and large consumers, but also in the unification of specifications having national recognition.

Although no attempt has as yet been made to compile lists of "willing-to-certify" manufacturers of paints and varnishes, several paint and varnish manufacturers have expressed their desire to supply material meeting United States Government master specifications. One of these manufacturers makes the following statement on the labels of his can:

> We guarantee that we will make goods conforming to the United States Government specifications as adopted by the Federal Specifications Board and issued by the United States Bureau of Standards whenever so issued or adopted by them.

In connection with his advertising literature, one of the prominent textile manufacturers certifies that every one of his trade branded sheets "fulfills all requirements of the United States Government master specifications No. 304 for high-count cotton sheets and No. 305 for high-count cotton pillow cases." Concerning his pipe unions a certain manufacturer states that they "conform to U. S. Government master specification No. 393" and are "also listed as standard by Underwriters Laboratories."

It is to be noted that the so-called "certification plan" has not as yet been applied to any of the specifications just referred to. Quite a number of other manufacturers have stated that they are now using, or planning to use, quality-guaranteeing labels with goods manufactured to comply with United States Government master specifications. One of these manufacturers makes three grades of liquid soap, marketed under three different brands. One grade is said to exceed the requirements of the Government specification by a certain percentage, and is priced accordingly; another grade, which is said to "answer every average requirement," is sold at a price somewhat less than that asked for the Government specification soap. The Government specification soap carries the following label:

> GUARANTEE
>
> This Liquid Soap is guaranteed to comply with the United States Government Specification No. 27 for Liquid Soap as adopted by the Federal Specifications Board, on June 20, 1922, when tested by method shown in circular of the Bureau of Standards No. 124. Copies of specification and method of testing will be sent gratis upon application.

By the widespread application of the quality-guaranteeing labeling system, based on certified compliance with nationally-recognized specifications, some of the benefits derived by the large-quantity and medium-quantity purchasers from using such specifications under the certification plan could be passed along to the small-quantity, "over-the-counter" buyer—the non-specifications-using public.

It is to be understood, of course, that the labeling system here referred to is inseparably associated with the certification plan and is not to be confused with the many systems now in operation involving labels the exact significance of which is seldom understood by the "over-the-counter" buyer who is therefore somewhat inclined to discredit all labels.

Much interest has been shown in the certification plan and labeling system by a large number of national and local organizations, including chambers of commerce, better business bureaus, colleges offering courses in commerce and business administration, women's clubs and federations, home economics teachers and associations. Judging from the correspondence with the officers of these organizations it seems evident that manufacturers could make effective use of labels showing compliance of certain of their commodities with nationally-recognized specifications.

The maximum benefit to be derived from the specification method of buying and selling will be obtained when the "nationally-recognized specification" for a chosen commodity has been so formulated as to cover the most satisfactory commodity in the best possible manner, the manufacturers place this commodity in "mass production" in accordance with this specification, the suppliers issue their certificates guaranteeing compliance with this specification, and quality-guaranteeing labels are based on the tests and inspections of this identical specification. The conditions here outlined are ideal and can be realized with very few commodities at the present time. However, they would seem to represent a proper goal for the various agencies concerned to strive to reach.

How Government Standards Affect the Ultimate Consumer

By Robert A. Brady
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UNDER the caption "Gains to the Consumer," an official publication of the United States Department of Commerce lists the following advantages flowing to the consumer from an application of the principles of Simplified Practice to industry:

1. Better prices than would otherwise be possible.
2. Better quality of product through ability of manufacturer to concentrate on better design and through the reduction of manufacturing expense.
3. Better service on—
   (a) Complete products
   (b) Repair parts
   (c) Prompt deliveries.

The Division of Simplified Practice comes under the jurisdiction of the Bureau of Standards, which is, in turn, a part of the Department of Commerce. This being the case, it is to be expected that the above statement represents substantially the views on this head of the officials in charge of the Bureau of Standards and the Department of Commerce.

From the official publications it is not always easy to determine just what groupings the writers have in mind when they employ the term "consumer." It is seldom clear that the "ultimate consumer" is being referred to, and it is generally obvious that the "intermediate" or manufacturing "consumer" is the object of consideration. But there is a considerable run of forceful, if somewhat ambiguous, statements to be found in the written work and the public speeches of the officials of the Department connected with standardization and research work which seem to permit of the construction "ultimate" on their use of the term consumer.

Indeed, Mr. Hoover himself has on numerous occasions committed himself to the belief that "these efforts are in the interest of the public," for, he says, "You and I are interested in this problem solely for a better service to our producers and consumers of the primary necessities and ordinary comforts of life." "We propose," he says in another connection, "more bonnets for the same money and effort." The elimination of waste, largely through standardization and simplification, will mean that "we shall have more goods and services to spend individually." From these and other numerous statements it seems in order to infer that the officials of the Department are, in this connection, publicly and officially, animated by a sincere and earnest solicitude for the well-being of the ultimate consumer. A survey, however, of the work accomplished and under way of the Bureau of Standards does not, at least superficially, support decisively this conclusion.

The Consumer, Government Standards and Specifications

The Bureau of Standards, among other activities, tests practically every conceivable type of commodity to be found on the retail market except food and drugs, drinking water and a few other things covered by the work of

other bureaus. Upon the basis of the tests specifications are drawn, stating the desired properties that must be possessed by the goods when used for a particular purpose. The indexes of United States Army and United States Government Specifications Adopted by the Federal Specifications Board give an encyclopaedic list of end consumption goods from toilet soap to silver ware which the Government purchases according to specifications drawn by the Bureau of Standards or with its coöperation.

Although in the laboratories a large proportion of all significant branded and trade-marked goods sold on the open market have been subjected to test, the Government but rarely purchases except under the specifications. Upon the basis of the written specifications, the Government makes contracts for purchase, following open bidding on the part of manufacturers desiring to secure the Government as a customer. The Government accepts no responsibility, financial or otherwise, for failure of the goods to comply with the specifications when delivered, all losses and expense, by contract, falling upon the manufacturer.

As a result of centralized purchasing under official specifications, the Government has saved large sums of money. It has been estimated that the net savings run as high as $100,000,000 per annum through the research and resulting standardization work of the Bureau of Standards alone, at a cost of around $2,000,000.

This sum of money, or whatever sum may be the correct one, is presumably saved the taxpayer, although it may be small consolation to those who view with apprehension the growing Federal budget. But the specifications as drawn, and the information held in the files of the Bureau of Standards upon the basis of which they are drawn, whether that information relates to branded or unbranded goods, is regarded as confidential, and to be used by the Government alone. The data may be had by municipalities and state governments upon application to the Bureau of Standards provided it is used only for local Government purposes and is not made public in the constituencies of the applicant. In other words, the vast store of information about common necessities, collected in the files of the Bureau of Standards, is not to be released under any conditions to the ultimate consumer to serve as a guide in purchasing commodities on the retail market. It seems to be felt that publication of this material is not the way to go about the job of "benefiting the public." The consumer, it is argued, might or might not understand what the specifications are all about. The chances are he would not. But whether he would understand or not, he is addicted to buying goods by brand name and price, assuming tacitly that there is some correlation, however intangible, between price and the quality desired as laid down in the tenets of the "cost-of-production" theory of value. However frequently he may be misled by specious claims, that habit of thinking is too deep-seated to be easily uprooted. It is probably desirable that it be not uprooted.

PRICE COMPETITION

How, then, is the consumer ever to get even approximately "his money's worth"? The answer runs uniformly the same: *through free competition.* A Division of Simplified Practice Bulletin quotes with approval William Feather, who says that:

> After a man has been in business for a few years he begins to realize that there is a natural law operating by which the benefit

of every new idea is passed on to the consumer. The business man gets the profits from his economies and efficiencies for a little while, but not for long. There is an irresistible force, just as potent as the law of gravitation, which takes these extra dollars and passes them around.

This sounds like "the obvious and simple system of natural liberty" which Adam Smith announced in 1776 as the universal solvent for economic ills. The *laissez-faire* theory has since undergone much wear and tear, but it is still the *leitmotiv* in current theoretical economic thinking. This is not the place to attempt any extensive critique of this theory, but it may be worth pointing out that *laissez faire*, even as originally enunciated, is not assumed by even the orthodox economists to work effectively except under specified conditions.

Some wag has defined *laissez faire* as "Each for himself and God for us all, said the elephant as he danced among the chickens." And that is where the rub comes in. The theory that the advantage of new improvements in the manufacturing process will ultimately accrue to the ultimate consumer in lower prices, better quality, or both is assumed only when all other factors remain the same, "by and large," "in the long run," and "on the whole." There is no "irresistible force" which takes the extra dollars and "passes them around" in the eyes of any economist, ancient or modern, which do not exist *de facto* or *de jure*. Where the laws of the land, the customs and habits of the people, the social, economic and political institutions are not of a suitable climate the *laissez-faire* doctrine cannot be realized in practice. Adam Smith himself wrote the "Wealth of Nations" with the object in view of showing that very fact, and in support of the thesis he inveighed against all the restrictions, governmental and private, which militated against "free competition."

The present is an age of combination and trade agreements. Horizontal combination, vertical integration, "Gary Dinners," trade association agreements, communities of interest through interlocking directorates, holding companies, etc., are universal contemporary phenomena. The elimination of price competition is the most common objective if one can judge by the histories of combinations. The obvious reason is that price competition cuts into profits and profits can be kept high if competition can be eliminated.

Advertising Opposed to Price Competition

The devices used to achieve this objective are numerous. Advertising has as one of its principal, if not its major, objectives the lifting of goods out of price competition. James H. McGraw, of the McGraw-Hill Publishing Company, who recently received a gold medal "for distinguished contemporary service to advertising" from the Graduate School of Business Administration of Harvard University, commends advertising because "It removes products from unhealthy price competition as fast as it can unearth distinctiveness in products and organizations. . . . It offers new weapons of quality and service in the business struggle with meager profits."

The Standard Oil Bulletin recently announced that "a price cutter is worse than a criminal," and then proceeded to state the "reasons why." The statement was widely quoted in the advertising and trade journals throughout the country. In any current issue of any of the numerous advertising and trade journals fragments of this contention can be found elaborated. Lillibridge, an advertising

agency eminent in its reputation as a seller of industrial products (appealing largely to the Engineering profession) states in *Time:*

> The final purpose of advertising is not to prove the comparative superiority of the article in competition. The object of advertising is to TAKE IT OUT OF COMPETITION, so that it will no longer be compared but will be accepted by the buyer.

When the advertisers announce that they are giving better "quality" or better "service" for the same money, they are at least giving lip service to the popular conception that there is some correlation between price and quality of goods. It amounts, in the popular apprehension, to the statement that they are lowering price, since the cost-of-production theory assumes a straight-line correlation between price and quality. If, then, advertising is devoted to the task of taking goods out of price competition, or, in other words, of preventing the cutting of price and the consequent cutting of profits, the net effect is to give less quality for the price charged rather than the reverse—that is in terms of the cost of production to the manufacturer. If this is the case, then the advertisers are guilty of either sophistry or hopelessly confused thinking.

Mr. Hoover recently endorsed advertising without serious qualification, leading one to believe that he does not realize, in view of his numerous statements espousing price competition, what the advertisers are about or say they are about. This would be unforgivable ignorance. If Mr. Hoover is not concerned with the fact, this, in view of his statements expressing concern for the public weal, would be sophistry or it would mean that he was caught off his guard.

All of the generalizations stated above are a matter of common notoriety to the average college sophomore who has taken a course in elementary economics, old-style or new-style. Any of them could relate the obvious facts that "price-competition" so stated, without serious and important qualifications, is a meaningless statement. To argue that it must aid the consumer through the interplay of "irresistible forces" is but to confer ignorance of the most patent facts of the modern market situation.

SIMPLIFIED PRACTICE

It should be noted also that much of the work of the Division of Simplified Practice is with commodities which do not vitally concern the ultimate consumer. Compared and contrasted with the end consumption goods listed for sale in the catalog of any mail order house, the projects undertaken by the Division seem to be utterly insignificant. Practically none of the goods important from the point of view of household expenditure, from safety matches to items of clothing, from kitchen tables to radio, have been touched upon by the Division.

A great deal of the Simplified Practice work relates to building materials used for a large part in the construction of office buildings, apartment houses and private dwellings. It is a matter of common knowledge that rentals do not in any essential sense depend upon the cost of construction. Cost of construction *is* a factor, but a minor one, in determining rentals. A much more important factor is land values, and it is impossible to separate land values from building values.

High building costs do not mean high rentals, nor low building costs low rentals in and by themselves. A view of the Hudson from the bathroom window is more instrumental in caus-

ing high rentals than the type of tile on the bathroom floor. It seems safe to say that reducing the cost of building materials is to divide the savings or profits between manufacturers and landlords.

Certification Program

Partial recognition of the fact that simple endorsement of the theory of free competition is not a cure-all for the industrial forces that may prevent the consumer from gaining from technological improvements is implied in the adoption by the Bureau of Standards of the Certification program. Briefly stated, the Certification plan provides an arrangement whereby manufacturers of a given commodity can enter their names on a "Willing-to-certify" list, indicating their willingness to manufacture the given commodity in compliance with the Government master specification. The goods sold to the public will presumably be advertised as having been so manufactured.

Many manufacturers have expressed their willingness to certify as provided in the plan. For the most part, the goods produced under the Certification agreements are not end consumption goods. The immediate gains, if any, go mostly to manufacturing consumers or toward lessening manufacturers' costs. In no instance is there any provision regarding what is to happen to price as cost of production falls. The Government does not propose to force the manufacturers to live up to the Government master specification even though the manufacturers have expressed their willingness to certify and are so stating in their advertising to the public. It is assumed here that competition and the "honest" manufacturers will take care of this end of the game.

One way the consumer, whether manufacturing or not, can check up on goods purchased for use from manufacturers certifying compliance with the Government master specifications, is by testing the goods as delivered. The Bureau of Standards has issued a list of Commercial and College Testing Laboratories to whom people interested can go for such tests. The list is not being widely circulated among ultimate consumers, and even were it so circulated there seems no direct reason for believing that as unorganized consumers, their voice would be at all effective in policing business. Again the argument falls, for all essential purposes, upon a confession of faith in the formula of free competition.

Finally, we receive this from an eminent technical expert in a Government Bureau:

> We may pity the poor ultimate consumer because he is not well organized and cannot protect himself, but every man, and the Bureau, must look out for its own hide first, and from that point of view we have to recognize that the ultimate consumer, being unorganized, cannot protest so violently at our acts of omission as the organized producers can protest at acts of commission. Hence, when in doubt, do nothing.

Plainer words are not required.

Summary

The Federal Government, whose officials have expressed much solicitude for the ultimate consumer, possesses a vast store of useful information which it refuses to make available to the general public, because of a feeling that it would do great damage to business, and because business, if let alone as provided in the theory of "free competition," will, through "price competition," be forced to pass the benefits on to the ultimate consumer who, presumably, thinks in terms of the cost-of-production theory. "We would not last a week," a responsible in-

formant suggests, "if we published the results of tests." There is no reliable evidence to date that the benefits of Government research, given to manufacturers, have been passed on to the consumer.

On the contrary, there is much reason for believing that the benefits are going no further than an increase in manufacturer's profits. The aid the Government has given to business has come at a time when combination of one sort or another and advertising are becoming most effective in stifling that competition on which the Government officials orally rely as the working force which will insure consumer benefits out of the business process. The rising curve of "distribution costs" would indicate a large measure of success for the advertisers.

In the face of the fact that all the advertising journals repeatedly declare their disbelief in the advantage of competition since the same cuts in on profits and further declare their intention of destroying its nefarious practice, Mr. Hoover has officially endorsed advertising. Many of the trades associations exist, patently and probably all of them in part, for the purpose of preventing price cutting. The Certification plan provides no protection to the ultimate consumer. Its teeth have all been drawn.

Lack of knowledge of the facts presented above would argue high incompetency on the part of the officials concerned. Knowledge of the same facts would lend color to the contention that the departments, bureaus, and divisions are concerned with aiding manufacturers and business men to increase their profits regardless of whom it may concern. The contention that "price-competition" either will occur under modern conditions, or if it should occur that it would, in itself and of necessity, and without widely accepted standards of quality and of trade practices, bring better and cheaper goods to the door of the consumer is either a bit of specious sophistry or an indication of appalling lack of knowledge of either economic "first principles" or of modern economic conditions. Certainly the burden of proof that this is not so is upon the responsible officials concerned and to date proof has been entirely lacking.

Can Standardization Reduce Advertising Costs?

By Hugh Elmer Agnew
Professor of Marketing, New York University

EACH year the cost of advertising in the United States is $1,250,000,000. That is an estimate which bankers and statisticians agree is conservative. What part of it, if any, can be saved by further standardization of products and extension of buying by specification?

The advertising manufacturer has an even greater interest in reducing his advertising expense than any part of the public including the reformers. It is a painful operation to separate a hard-headed, tight-fisted board of directors from a lump sum for advertising that might, if applied to dividends, double them. Relief from the ever-growing competition in advertising, whether by standardization, or any other legitimate device which will not jeopardize the good will of the business, will be most welcome. To what extent will standardization help?

In the table below are 23 classifications of goods, and, with each, the amount of money spent to advertise it in the 32 leading magazines of the country in 1926. These are the latest figures available at the time this is written. Probably the division of advertising funds in other media would be roughly parallel.

Magazine Advertising Expenditures for 1926 by Classes*

Automotive industry	$21,186,884
Building materials	6,790,164
Cigars, cigarettes and tobacco	2,268,247
Clothing and dry goods	7,438,626
Confectionery and soft drinks	2,286,503
Department, mail order and chain stores	815,130
Drugs and toilet goods	$19,787,927
Foods and food beverages	21,093,402
Furniture and furnishings	15,354,993
Garden	346,246
General (non-manufactured products)	5,319,635
Jewelry and silverware	3,548,428
Lubricants and gasoline	2,419,011
Machinery and mechanical	1,673,869
Musical instruments and radio	5,040,632
Office and store equipment	2,251,329
Paints and hardware	3,977,986
Shoes and shoe furnishings	2,700,833
Soaps and housekeepers' supplies	6,153,697
Sporting goods	591,805
Stationery and books	3,781,936
Travel and amusement	4,054,649
Miscellaneous	567,256
	$139,449,188

* Figures are from *National Markets and National Advertising*, compiled for the Crowell Publishing Company.

Class 1. The leading advertising industry, as might be expected, is automotive vehicles and accessories. With the full interchange of patents that prevails, and the employment of hundreds of engineers, standardization is here possible on a scale that few other industries permit. Yet the style element remains supreme. It is impossible to sell an unadvertised car at a profit. Here standardization offers no relief from the burden of advertising.

Also, the full equipment of automobiles with roller bearings, speedometers, bumpers, etc., etc., has largely been forced by advertising. Even such materials as vanadium steel were neither accepted nor adopted by the engineers until it was forced upon the attention of manufacturers by magazine advertising.

Class 2. Building Materials. Here again the work of standardization has gone a long way. Indeed, it has gone so far that improvements often have to

be forced by advertising to get consideration from architects. This was the case with an improved radiator valve. For two years, personal salesmanship and advertising in architectural and plumbing publications made little headway until a consumer advertising campaign created a demand on the part of owners that architects and builders *had* to recognize.

The sizes of windows, doors, and materials, have been standardized to the great benefit of all concerned. Contractors give building owners a choice of several heating plants, all so similar that there is scant grounds for selection, yet the manufacturers continue to advertise.

On the whole, the advertising for building materials is increasing rapidly. In 1922 the amount spent in magazines was just under four million dollars. In 1926 it was nearly seven million. Here, as in many instances, standardization has helped to reduce manufacturing costs—including building—but it has not yet helped to reduce sales costs.

The experience of many manufacturers, like those making face brick, is that they can educate the public *and* the architects for less money than they can convert the professional men alone.

Class 3. Cigars, Cigarettes, and Tobacco. Obviously standardization can furnish no relief in sales costs for these items except in reducing the number of brands. When the General Cigar Company was organized it cut down the number of brands of its component members from 152 to five. That effected a vast saving in the cost of manufacture and considerable in sales costs, especially if printing fancy labels is regarded as a selling cost, at least in part.

Class 4. Clothing and Dry Goods. Style articles, which constitute a very considerable part of this classification, are admittedly out of consideration. Standardizing sheetings, hosiery, and other staple goods would seem to offer possibilities. But no store wants to admit that it has exactly the same goods as every other store. That is why so many object to handling advertised brands. They want something different.

One of the leading shoe manufacturers holds the trade of two of New York's largest shoe stores by putting the store's name, rather than the manufacturer's on stock shoes.

Relief in selling costs through standardization is a remote possibility in this classification. For even if standards were adopted, it would take years and cost millions to teach the public to understand and accept specifications.

Class 5. Confectionery and Soft Drinks on the one hand, and

Class 6. Department Stores, Mail Order and Chain Stores on the other, offer little for interesting discussion. They help to illustrate, however, one of the forms of standardization adopted by marketing men. Practically all advertising records are now founded upon the same classification of goods—the one given here.

Class 7. Drugs and Toilet Goods. The average druggist carries about 5000 different articles of household use. The very magnitude of teaching the public to recognize by brand name more than the commonest ones is appalling. But what about instructing them to understand specifications? The imagination falters.

Advertising has helped to reduce the number of brands of tooth paste to less than forty. The shaving creams are nearly all sold under less than ten brands. Six or eight of the great drug manufacturers prepare nearly 60 per cent of such common remedies as milk of magnesia and cascara. Stock of an

even half dozen toilet soaps constitutes a good assortment. Thanks to enterprising advertisers, this small number of brands effects a great economy in retailing. It reduces the investment, the amount of space required for storage and display, spoilage from shelf-ware, and trouble in keeping up supplies.

Perhaps chemists will devise a perfect toilet soap, and so standardize it that it will be as staple as granulated sugar. But so far they haven't. Yet if they do, it would take millions in advertising to convince a skeptical public that the formula soap was better than the one they had bought by name.

Class 8. Foods and Food Beverages. Only a few of the foods are advertised, and they are in the nature of luxuries rather than staples; like granulated sugar mentioned in the above paragraph. It is extremely doubtful if standardization or specifications can be substituted for brands which people have found reliable. A few years ago, what was then The General Chemical Company, put out a new baking powder which was as nearly perfect as the best chemists could make it. But it was finally abandoned after an immense loss. People simply would not accept it. To the Smiths and Johnsons and Joneses and Cohens food chemist meant one who concocted adulterants and substitutes, many of which were questionable. The fight brother chemists made against Dr. Wiley had stamped them as enemies of the people, even as the good Dr. Wiley was the friend of the people.

Now the chemists have reformed—many of them—they no longer make a living by preparing coal tar products to sell as fruit juices. But Mrs. Soloman of New York, Mrs. Ashley of Omaha and Mrs. Mason of Seattle have not yet heard of the reformation. Their confidence has not been restored. They do not want goods made after the specifications of those chemists. And unfortunately it would cost more to *sell* the food chemists to the country than to advertise many brands of foods.

Furthermore, and even more important, is the fact that the gustatory qualities of most foods cannot be determined by chemical analysis. Even the Government has despaired of chemical analysis as a basis for fixing the quality of tea for import duties, and relies upon a "tea taster."

Class 9. Furniture and Furnishings. Is it possible that Sinclair Lewis is to be further tortured by a greater standardization of home furnishings? Animosity for the Babbits is founded upon a lack of taste evidenced in standardized living. Surely manufacturers of goods of this class cannot hope for relief for their magazine advertising budget of $15,350,000 in the near future By the way, that budget has more than doubled in the last five years.

Classes 10 and 11. Garden Supplies and Non-Manufactured Products include such businesses as insurance and correspondence schools; all are obviously outside of standardization influence in so far as advertising is concerned.

Class 12. Jewelry and Silverware. Here advertisers have taken the matter of standardization into their own hands and have agreed upon the use of such terms as sterling, plate, and even what constitutes "silverware." But the magazine advertising has increased more than a million dollars since the standardization of terms.

Class 13. Lubricants and Gasoline. Here surely would seem to be an opportunity for standardization to offer relief in advertising costs. From 80 per cent to 90 per cent of the business is handled by five of the great oil companies—counting the Standard Oil group as one. Few consumers have a decided preference for any brand of

gasoline, and no particular reason for choosing any one lubricant rather than others. But the advertising is such a small cost of the consumers' price that they cannot hope for much relief. From 1 per cent to 2 per cent of the refiner's sale price makes a liberal advertising appropriation. Refiners continue to increase their advertising appropriations, evidently convinced that it is necessary for a growing business.

Class 14. Machinery and Mechanical Supplies. This includes electrical supplies—other than radios and vacuum cleaners—as well as pumps, belting, water supply plants, etc. I do not feel capable of discussing the effect of standardization upon this class. But from an advertising standpoint it is not very important, as the whole amount spent in magazine advertising in 1926 was $1,673,869.

Class 15. Musical Instruments and Radio. Radios are still in the formative period. Pianos are quite generally standardized in most important features. Phonographs have recently undergone a sweeping change. But the advertising for all continues. It is largely devoted to educating people to an appreciation of the pleasures that music will bring into their lives. So it will be unaffected by further standardization.

Class 16. Office and Store Equipment. Quite generally standardized, but still advertised.

Class 17. Paints and Hardware. That paints and varnishes might be more highly standardized for the benefit of all concerned seems probable. It also seems probable that if wide publicity were given to the specifications used by the Government in buying paint supplies, it would enhance paint values for many consumers. Such publicity could conceivably compel changes in manufacturing processes for some of the best known brands of paint and varnish. But with the immense cost of public education in what constitutes a good paint, and with the development of such new products as the celluloid paints, it is not apparent that standardization can reduce the selling costs in the paint industry, at least not for quite some time. As to hardware and tools, advertising has never been an important item except with three or four manufacturers. All of this advertising in the magazines for 1926 amounted to but $650,000.

Class 18. Shoes and Shoe Furnishings. Here again the style element is of major importance. Men's shoes are more generally sold by brands than women's shoes. Both in the number of pairs and in the amount of money paid for them, the sale of men's shoes has been actually on the decrease for several years. Probably half of the footwear for men carries the brand of the manufacturer. Less than a fourth of women's shoes are sold under manufacturers' brands. There has been a moderate increase in the dollar sales of feminine footwear, probably due to the style appeal, high prices, a fragile product, and the social necessity of having shoes of different colors. Standardization will offer no relief.

Class 19. Soaps and Housekeepers' Supplies. Owing to extensive advertising of the leaders, the number of soap manufacturers has decreased from over 1200 to less than 400 since 1915. Even such extensive operators as Procter & Gamble have not found it possible to reduce soap making to a formula. So standardization or specification buying seems hopeless with soap.

Other supplies like insect powder, brooms, starch, etc., offer no great possibilities. They make up a very small part of the family budget.

Class 20 and Class 21. Sporting Goods, Stationery and Books. These do

not fall within the present practical application of standardization as seen by the marketing man.

Class 22. Travel and Amusements. The one striking example of standardization found in this class is the famous Century Limited and, its leading rival, the Broadway Limited. Both trains are so similar that if a "section" of one should be switched on to the other's track, passengers might not discover the difference. Both leave New York and arrive in Chicago at the same time. The fare is the same, the over-charge the same. Yet the well-advertised Century carries about three times as many passengers as its competitor. Standardization here has not reduced either the costs or effects of advertising.

Class 23. Miscellaneous. This includes telephone advertising, wireless for communicating with ships, grave vaults, tombstones, dog biscuits, political advertising, etc. It amounted to a little over $500,000 in 1926, and is not important.

Of the 23 classifications of goods, only two—Lubricants and Gasoline, and Paints and Hardware—seem to be of a nature to permit reduction in advertising expense by standardization. In neither of these is it certain that such a result would follow: they offer only possibilities.

The writer is aware that the excessive influence of style is often charged to advertising. And he is frequently told that if the advertising were discontinued, a more durable standardized product would result. Real students of marketing know that to be an error. Advertising graveyards are filled with the remains of those who have tried to dominate styles. Pope and Columbia bicycles were extensively advertised; hairnets were supported by the most extensive and expensive publicity; Heatherbloom petticoats and Warren's "featherbone" were once featured in every woman's magazine. Where are they now? Fashion decreed that they must pass. And like the laws of trade, dictates of fashion are stronger than the laws of nations.

No wise advertiser attempts continuously to dictate styles. He follows and profits rather than leads and fails. Advertising can speed and spread and prolong fads until they become fashions. It cannot, except on rare occasions, create fashions. In a very substantial way, advertising is a factor in standardizing style goods. There are fewer styles at any one time than there would be without advertising. Bobbed hair and knee-length skirts are not confined to fashion centers. It is very different now from a half century ago, before advertising became a real factor in our lives. Lincoln complained that his tailors did not make the kind of clothes that were worn in New York and other smart Eastern cities. Now man's dress on Broadway, New York; Main Street, Kokomo; and Pike Street, Seattle, are of one pattern—highly standardized. The fashion pages of the magazines have brought this about, or at least made it possible. The same influence has nationalized, even if it has failed to standardize, women's wear.

Advertising and standardization should not be antagonistic. In the cooperative marketing of farm products, standardization preceded and made advertising possible. Oranges, apples, raisins, and prunes had to be rigidly sorted and graded before they could be profitably advertised. Indeed, spreading the news of a dependable (standardized) quality constituted a very considerable part of the advertiser's message.

In another field of marketing, the lack of standards is prohibiting profitable advertising in many cases. That is in coöperative advertising. This,

by the way, should be distinguished from coöperative marketing. In the latter, producers turn their products over to a central agency for distribution and sale. This agency may or may not advertise. In coöperative advertising, competitors who sell their products independently may unite to extend their markets by advertising. The "Save the Surface" advertising of paint and varnish manufacturers, and the "Say it with Flowers" campaign of the florists, are examples of coöperative advertising.

As standards for whole industries are adopted, it will be necessary to educate consumers as to the value of these standards. This will mean advertising. Also, advertising will still be necessary to meet indirect competition, which is fast coming to be the most sharply competitive advertising in the whole competitive field of marketing. One industry competes with another rather than one manufacturer with another. The automobile is a more dangerous competitor to the Erie railway than any other road. Wall paper competes with paint; composition roofings with shingles; the radio with the phonograph, and both with pianos; cereals with meats; food with clothing; moving pictures with house furnishings; and so to the last article on the shopping list. Literally every one, including the savings banks, is bidding for your dollars, just as you are bidding for theirs. When all these goods are standardized to the farthest practical limit, there will still be competition that will avail itself of the influence of advertising until some more effective means of educating buyers is discovered.

As the market man sees it, standardization pertains to staples, and advertised brands to goods of the luxury class. The part of the family budget spent for advertised goods has never been accurately determined, but is relatively small. This is indicated by the sales of retail stores which advertise. About one-fifth or one-sixth of sales are goods which the store features in its announcements. The other four-fifths or five-sixths of sales are of goods not mentioned. Standardization is thus left the major part of the family budget and, both in manufacture and distribution costs, it is making an effective saving. But there seems to be little possibility at present that it can relieve the advertising burden.

Book Department

BEARD, CHARLES A. and MARY R. *The Rise of American Civilization*. 2 volumes. Pp. Volume I, 828; Volume II, 824. Price, $12.50. New York: The Macmillan Company, 1927.

In plan, scope and method of treatment this is a monumental work which should occupy a high place in its field. The plan is a synthetic view of American progress. The scope includes chiefly economic, but partly also political, social, and scientific factors.

The method of treatment is a flowing narrative commencing with English colonial policy and ending with the so-called machine age of present-day America,—an interpretation but not a discussion. The work is divided into two main epochs, the agricultural and the industrial, a division which is, of course, a loose and approximate but convenient one. In the agricultural age the authors sketch the settlement and growth of the colonies, the English trade policies, the clash between metropolis and colonies, the approach and culmination of the revolution, the slow cementing of the new nation, the rise of the new agricultural states in the West and the final growth westward to the Pacific. The economic influences of agriculture, free-land and slavery in creating political issues are clearly set forth in an interesting chapter on "The Politics of the Economic Drift."

In the industrial age one hears first the rumbling of an approaching and irrepressible conflict, the clash between Northern industry and Southern slave-holding agriculture. Next the struggle itself, and then "the second American revolution." This revolution was industrial as well as political and social.

Next comes the organizing of the Western areas of our land and the rise of a distinct spirit of business enterprise in which organization, management, industrial initiative and large scale production played the essential rôles. There follows the political effect of industrial growth, the search for more worlds to conquer, the rise of the imperialist policy.

In the penultimate era, "the gilded age," the authors sketch the gradual decline of old standards and ideals in business, in social relations, in politics and in the morals of everyday conduct. This age seems to serve as a solvent or transition from the primitive American to the modern sophisticated view of many things, from national policies down to national tastes in humor and art.

Closely following it comes the trend towards social democracy. Comparatively little space is given to the Great War, but much to the return to normalcy and the overwhelming triumph of the industrial machine age. In this triumph not only industry but all phases and stages of distribution, art, theatre, religious organization and social uplift were made to follow the conquering chariot of the spirit of standardized organization.

Shall the power of the industrial machine subdue and tame all the forces of human energy physical and spiritual? Or, can the machine itself by the "invention of invention," that mysterious instrument of the modern mind, be made the servant rather than the master?

The authors conclude by quoting without endorsement the general opinion, as distinct from that of the specialists, that unlimited progress is still before us. This is based on the invincible belief in democracy, in the ability of the masses, "as contrasted with heroes and classes" to meet effectively the issues which are to come.

The method of treatment is distinctly uneven and varied. There are no footnotes, no detailed references even to quotations. The narrative flows like a tale; it roams freely and at times capriciously over vast stretches. Occasionally it pauses for a moment and one listens to an intensive description of some typical incident. The style runs easily and there are in places delicate shadings and nice discriminations of meaning contrasting with broad impressionistic dashes of color. As the narrative nears recent events the tone becomes

ironical and even caustic. The reader feels that the men of the present generation in business and politics alike will bear watching; he feels also more keenly than before the insidious approach of large organizations of predatory wealth and their ever stronger control over national welfare and national policy. At the last one has a distinct sensation of uneasiness in reviewing the steady inexorable march of plutocracy. It is hard to escape the conviction, which the authors however nowhere specifically state, that Wall Street has captured us body, soul and breeches.

The style is clear and interesting. It is hard to lay the book down. One might wish for an occasional kindlier estimate of public men or a lighter touch of acid on the motives that are woven through recent events, but one never finds the narrative dull.

The work gives evidence of intensive and prodigious reading, also of an admirably organized process of boring, extracting, assembling, appraising and ever questioning. The distinctive contribution of the work is the successful effort to review all phases of American history from an economic standpoint.

JAMES T. YOUNG.

WILLOUGHBY, W. F. *Principles of Public Administration*. Pp. xxii, 720. Baltimore: Johns Hopkins Press, 1927.

Professor Willoughby's avowed purpose in writing this 700-page volume has been "to resolve the exceedingly comprehensive and complex problem of public administration into its constituent elements" in order to present "a general analysis and picture of administration as a branch of political science." As Director of the Institute for Government Research at Washington, the author has had an unique opportunity to study in combination the theoretical and practical sides of the administrative technique. The special phases of public administration which receive consideration are General Administration and Organization, Personnel, Material, and Finance.

According to the subtitle of the volume, it is the aim of Professor Willoughby to consider the principles of public administration as these have developed both in the national and state governments of the United States. It is evident, however, that the author's acquaintance with the facts in the field of state administration is somewhat limited. For example, in the discussion on Finance, to which he devotes over two hundred pages, the matter of executive control of expenditures in the states is passed over with the remark that "information is not at hand to permit of a statement" (p. 504). In view of the emphasis given in the introductory chapters to the managerial phase, and particularly in view of the very lengthy discussion on the preparation of the budget, it is somewhat surprising that the execution of the budget should receive such slight consideration.

There is also a tendency in certain portions of the volume to state "principles" in rather cavalier fashion. For example, on page 11, one reads that the administrative function "resides in the legislative branch of the government," and yet the administrative function, as defined by the author on the same page, "is that of actually administering the law as declared by the legislative, and interpreted by the judicial, branch of government." In the opinion of the reviewer, this is tantamount to saying that the legislature is the executive. The fact that the legislature is the source of administrative authority certainly does not make the function of administration reside in the legislature. One is likewise inclined to question the premise that the legislature is the source of all administrative authority. Also to say that the constitutional doctrines of *United States* v. *Kendall* and *Kendall* v. *United States* have not been disturbed since the day they were first issued, as Professor Willoughby would have us believe, is to ignore completely both legal opinion and the facts of administrative practice since the time of Andrew Jackson.

It is evident that the author has given careful study to the problem of the reorganization of the national administrative services, although students of administration will be tempted to take exception to some of his suggestions. While he is a strong advocate of the idea of integration, he recommends that revenue-producing services should be set up as distinct public or quasi-public corporations. This would mean

administrative autonomy for the Postal Service, the Panama Canal, the Alaskan Railway, the Inland Waterways Corporation, the Merchant Fleet Corporation, etc. Agencies exercising quasi-legislative and quasi-judicial duties should be relieved of duties of a strictly administrative character, and then the activities of these agencies should not be subject to executive direction and control.

The problem of Personnel and the problems of Accounting and Auditing are treated in great detail. It is in these chapters that the author brings together valuable and useful material. It is also here that the principles elaborated show the results of careful and intensive studies of the problems considered. This discussion, together with the discussion on preparing and formulating the budget, represents the best part of the work.

While the author might have condensed his material and reduced the volume to two-thirds of its present size, nevertheless, he has presented us with a useful and thought-provoking text for the study of public administration. The summary descriptions of bibliographical material enhance considerably the merits of the volume.

MARTIN L. FAUST.

HERSHEY, AMOS S. *The Essentials of International Public Law and Organization* (revised edition). Pp. xxii, 784. New York: The Macmillan Company, 1927.

This revision of Professor Hershey's well-known text combines the excellencies of the original edition with some useful innovations. Among the former is the careful distinction between text and footnote which has made possible a concise text indicating the established doctrines of law, in close proximity with a wealth of illustrations and references for further reading in the footnotes.

The introductory historical chapters have been brought up to date, and, as the title indicates, in the body of the book the new developments in the field of international organization have been stressed. The author is convinced that after the temporary setback of the World War the "new world order has secured a fairly firm footing" and that, "mainly due to the agency of the League of Nations, international law is passing through the greatest period in the history of its development" (p. viii).

The practice followed in the original edition of quoting in the text pertinent extracts from international documents, like the Hague conventions, has been continued in the case of the League of Nations Covenant and the statute of the Permanent Court of International Justice. The opinion of the author on the relative importance of the different fields of his subjects is indicated by his relegation of the "so-called laws of war and neutrality" to less than one-third of the book.

The revision has been careful and the index is complete. Teachers and students will find the book a thoroughly usable text and investigators will usually find in the voluminous footnotes references for further study of almost every problem.

QUINCY WRIGHT.

MACDONALD, AUSTIN F. *Federal Aid: A Study of the American Subsidy System.* Pp. xii, 285. New York: T. Y. Crowell Company, 1928.

This book presents a systematic survey of federal grants in aid to the States and their subdivisions, and is written on the basis of an extensive field study covering a large part of the United States, in the course of which Mr. MacDonald made a wide range of contacts. The volume describes *seriatim* our experience with federal grants in forestry, agricultural extension, highways, the National Guard, vocational education and rehabilitation, and the hygiene of maternity and infancy.

Here may be found the most extensive description of federal aid which has yet been written, together with some extremely important generalizations which go far to substantiate belief in the wisdom of a reasoned development of this administrative device. Thus the author concludes, *inter alia*, (1) That federal aid has stimulated state interest and activity, (2) that it has raised state standards and established a national minimum of efficiency, and (3) that there has been no unreasonable federal interference with state policies or with the details of state administration. He reports also that state politics has not been eliminated from

coöperative work, although its influence has been reduced.

One wishes that Mr. MacDonald had felt more free to reveal the inner working of the federal aid system. For the most part he draws a discreet veil over the points at which friction has arisen, which after all are precisely the points at which the real issues arise. His illustrations are too often anonymous and the enormous number of specific cases which must have come to his attention and which would have been of the liveliest interest to the student of administration still remain in his brief case. One misses also a general but critical view of the whole subject, which Mr. MacDonald is so well qualified to give.

These comments need not disguise the fact that the volume is a much needed contribution to an important field of inquiry, which should be examined and reëxamined from many points of view.

LEONARD D. WHITE.

University of Chicago.

CALLENDER, CLARENCE N. *American Courts.* Pp. viii, 284. New York: McGraw-Hill.

This book is extremely well written. Though by a Philadelphia lawyer, it does not take "a Philadelphia lawyer" to understand it. It elucidates our court systems, both state and federal, in words of one syllable for the laity. But let not any lawyer turn up his nose at it on that account. This reviewer, though a teacher of law for many years, found its perusal both pleasant and profitable, and is going to recommend its purchase to all his first-year students. The appendix, showing in tabular form the court systems of the various states, is valuable. The chapter on commercial arbitration is interesting. The one on the federal courts is clear without being involved; and a perusal of it would have saved two lawyers the humiliation witnessed the other day of being thrown out of the Supreme Court on technicalities. The author has wisely refrained from attempting explanations that would involve legal learning, as where he follows the language of the statute in stating the jurisdiction of the Court of Claims, even though a delusive simplicity is the result. Delusive simplicity is inseparable from the kind of thing here attempted. Particularly valuable to non-legal readers will be the description of every step in a cause, beginning with the relation of attorney and client. In a concluding chapter on the reform of legal procedure the author does his bit toward educating the public in the difficulties involved and in the realization that a great wave of public sentiment must be created in order to achieve progress. In so far as his book helps to an understanding of the existing situation it will help the cause of reform.

HECTOR G. SPAULDING.

ARNESON, BEN ALBERT. *Elements of Constitutional Law.* Pp. 359. New York: Harper and Brothers, 1928.

The purpose of this book, the author tells us, is twofold: it is designed for the general reader who desires an introductory survey of American Constitutional Law, and also for the student in Liberal Arts courses in that subject. The first of these objects is undoubtedly secured; for the book gives a clear, brief exposition of the American Constitution as it has been developed by the Supreme Court—a statement unhampered, so far as it is humanly possible, by erudite citations of cases. The second goal, however, is not quite reached, for it necessarily lies somewhat off the main road which leads to the first. The book is a little too elementary for the college student, even though it be used only as a clamp to hold the multifarious parts of a case-book together. The unusual scarcity of case citations becomes for the student a fault rather than a virtue, and he misses also the suggestive criticism which he can find in an author such as Burdick.

R. MACGREGOR DAWSON.

POLLOCK, JAMES K. *Readings in American Government.* Pp. xiv, 354. New York: Henry Holt and Company, 1927.

The author of these readings states in his preface that the selections "have been made with a view to bringing the student or general reader into contact with many of the significant men who have either occupied the governmental stage or have been peculiarly situated or fitted to depict the important phases of American politics."

These words "should reveal to the reader the real value of governmental institutions, just as good literature reveals the soul and life of a people." He proposes to choose the classic rather than the ephemeral in the literature of American political institutions. A brief introductory statement before each selection adds to the understanding of the circumstances surrounding each contribution.

There can be no doubt but that the choice of the author of these concise, clear, comprehensive, and readable writings, speeches, or decisions of the courts has been above the ordinary. It is a difficult task to form judgments on fragments of political literature, some long extant and worthy of frequent reading, some of recent origin, and worthy of presentation with the classics. The task of elimination of material on the one hand, and of satisfying the particular needs of the classroom on the other, has been excellently done by Dr. Pollock. The combination of portions of *The Federalist* and early constitutional writings and decisions of the founders and expounders with the later views of Wilson, Roosevelt, Root, and Bryce, among others, tends to give the readings a scope and importance which is a great credit to the author and a worthy volume for the study of both student and general reader.

EDWIN A. COTTRELL.

DENNIS, A. L. P. *Adventures in American Diplomacy*. 1896–1906. Pp. x, 537. Price, $5.00. New York: E. P. Dutton, 1928.

Our present international prominence has led to the making of many books on diplomatic history. Six stout volumes on our foreign policy have appeared within the past two years. This book relates the "inside story" of the most perilous period in that history. Professor Dennis analyzes it and substantiates his analysis with documentary evidence. The great contribution of the book is its revelation of this information—largely based on material previously unpublished.

The title is well chosen. The decade 1896–1906 was a period of adventure in our diplomacy—a time "when the United States ventured forth on seas that were unknown to the vast majority of Americans." Contrary to the usual belief, Dr. Dennis does not hold that we were isolated in 1896; we simply at that time cared little for diplomatic questions. The book is a critical commentary on our relations to other nations in certain outstanding international incidents—the Venezuelan boundary dispute, the Spanish American War, problems of the Far East (especially in Hawaii, China and Japan), the Panama and Caribbean policies, and questions in Africa and Turkey. It is really a series of essays touching the high lights in the crucial decade of American foreign policy, since "almost any chapter in this book can be read independently." The book is "a sign post to materials" rather than a history. It aims not so much at changing our opinion as it does at making that opinion an intelligent one.

Professor Dennis is an historian, not a propagandist; we wish he might have injected more of his own conclusion into print, at least in a final chapter. He writes to give data for conclusions which the reader is left to draw for himself. The discussion is scientific rather than popular. Diplomacy is dry in the written description. The author takes out the dryness by emphasizing persons rather than principles, and by a racy style of writing. (*Cf.* page 321—"soon he was to go to France to restore the wilting *morale* of men who thought they saw $40,000,000 go glimmering"; page 332—"where bottle after bottle of champagne was poured over the head of General Huertas"). The account lives, too, because of the personal touch of Olney, Hay, Root and Roosevelt.

To use financial parlance, the book may be said to uncover no previously "unknown deals," either honorable or dishonorable; it shows rather why the directors voted as they did and what they said to each other before the ballots were cast. This "inside story" represents extensive research in archives and painstaking accuracy in editing the data. Our diplomatic record is not blackened by the book; we simply understand our blunders better. "There was no diplomatic service in those days." "Too often the vote of a Senator for a treaty, which had a perilous passage to face in the

Senate, could be saved by the appointment of a consul or higher official on his recommendation" (page 518). We can be thankful that experience and the Rogers Act have bettered the system.

HARRY T. COLLINGS.

HARING, CLARENCE H. *South America Looks at the United States.* Pp. vii, 243. New York: Macmillan Company, 1928.

"South America Looks at the United States" appears at an opportune time, when increased attention all over the world is being focused on South America and on the relations of the United States of America and South American Republics. With the debates and sometimes heated discussions of the Sixth International Conference of American States at Cuba a matter of history, the book can be read with increased pleasure.

The volume, an outgrowth of a year's residence and travel in South America, in 1925–1926, by Clarence H. Haring, under the auspices of the Bureau of International Research of Harvard University and Radcliffe College, represents a sincere and apparently unbiased effort to arrive at an understanding of some of the more outstanding factors that influence the relations of the people of the United States with those of the nations of the southern continent. It is divided into three parts:

In the first part is set forth (1) the various steps by which the United States of America developed its Caribbean policy of protection and intervention, and economic and commercial penetration, (2) the chief characteristics of the nations of South America as producers of foodstuffs and raw industrial materials, as a home for immigrants, and fields for investment, (3) and an historical statement of Inter-American Relations.

In the second part the author discusses the more important sources of distrust embodied in the divergence in temperament and traditions between the Latin or Indo-Latin races and the Anglo-Saxon, in the methods and extent of economic and financial penetration, in the misunderstandings of the Monroe Doctrine and Pan-Americanism, in the unfriendly propaganda: propaganda of European origin whether political, commercial, or intellectual, propaganda in favor of a cultural and political union exclusively Latin in America, and propaganda emanating from hostile or ill-informed critics residing in the United States, in the movement by Spain for a "spiritual reconquest" of its lost colonies, the creation of a political *bloc* (the Pan-Hispanic Union) of all the nations of Latin America under Spanish leadership, and in the kindred movement by France and Italy to develop Pan-Latinism with France as an affectionate stepmother."

The third part analyzes the feelings of the several South American republics towards the United States. While beneath all there is a certain resemblance throughout the continent, there are considerable differences occasioned by disparity of national temperament, by diversity of national ambition, and diplomatic and other experiences with the United States that have left a sense of suspicion or distrust. Public sentiment is not uniform; it varies from one republic to another and even from one social or political group within a state.

It is a distinct pleasure to delve into the pages of this book, in which the author has attempted to analyze in apparently an unbiased manner the many and complex relations of the United States of America with the nations of South America, a continent that stands on the threshold of an era of material and intellectual progress, increasing European immigration, active development of natural resources, expanding transportation facilities by land and by sea and of increasing political stability. A wide reading of this volume both in North and South America would do much to clear away misunderstanding and to foster better relations.

CLARENCE F. JONES.

WILLERT, SIR ARTHUR. *Aspects of British Foreign Policy.* Pp. 141. Price, $2.00. New Haven: Yale University Press.

In this little volume of six Williamstown lectures the Chief of the Press Bureau of the British Foreign Office gives a rapid survey of British foreign policy since the war. The objectives of British foreign policy are stated to be peace, security, and

trade. The changed economic, financial and naval position of Great Britain in the post-war period, which forms the practical basis of this policy, is discussed, but with no special penetration.

Lectures II and III, covering the familiar story of diplomatic events in Europe from Versailles to Locarno, add little to the common knowledge on the subject. Lectures IV and V deal with the Chinese problem and are the best in the series. Western, and in particular British, policy with respect to China in the past, is critically handled, while the demands of China are given sympathetic treatment. Present British Chinese policy may be a bit idealistically portrayed. The last lecture, on the Russian Question, reflects strong approval of the Conservative policy.

A. VANDENBOSCH.

RANDALL, JAMES G. *Constitutional Problems under Lincoln*. Pp. xviii, 580, Price, $4.00. New York: D. Appleton & Co., 1926.

This is a book of constitutional history, but constitutional history from the broader standpoint; as the author defines it "not the study of a document, but rather of a social process—the process by which a community reëxpresses from time to time its will concerning its government, refitting, reinterpreting, and expanding its fundamental law so as to keep abreast of new issues,"—a definition much to be commended by any one who believes that constitutional history can be made interesting as well as scientific. The result is a book which takes into account not only the legal questions involved, but also the social and economic problems, and the human actions which gave rise to them, and especially the reactions of Lincoln's own personality to the situation.

The treatment is topical with due consideration of chronology, including the general constitutional and legal principles involved, with their incidence on the individual in the application of the law of treason; the privilege of habeas corpus, and martial law in its application north and south; conscription and its constitutionality; confiscation and emancipation; the relation of the national government to the states, with special consideration of the case of West Virginia; and the problem of press control. This work is the result of fifteen years of research, expanding from a dissertation on the confiscation of property. It is fully documented. The author has made an exhaustive study, not only of the usual printed material, but of all available manuscript sources, including the new and significant diary of Senator Orville H. Browning of Illinois, as well as the usually unprinted court records. His annotated bibliography (in which Burgess' *Civil War and the Constitution* might well have been included) will be useful not only to the professional historian but to the graduate student, and intelligible even to the undergraduate. Professor Randall has given us a highly valuable work not only to the specialist in the period, but for the study of parallel questions arising during the World War, and for any study of general American constitutional history. It is readable and understandable for the layman as well as the student.

GEORGE M. CHURCHILL.

JONES, HOWARD MUMFORD. *America and French Culture, 1750–1848*. Pp. xvi, 615. Price, $5.00. Chapel Hill: The University of North Carolina Press, 1927.

Although Mr. Jones professes literature, he has written here a book that is of tremendous value to all scholars in the field of the social sciences. Indeed he has devoted the whole of this volume to a consideration of the social forces, at work in America, that have been affected by French culture; the task of showing French influence on our literature he has relegated to a second volume not yet written. It is necessary and right that he should do so, for literary historians are becoming more and more of the opinion that the writings of a people cannot be dissevered from their social and political lives. In order to appreciate the one, the student must first have intimate knowledge of the other.

The reader is at once impressed with the scholarly manner in which Mr. Jones has proceeded. He admits readily, in more than one place in the book, that there are of necessity obvious gaps in his material. The field is too broad to be handled in its

entirety in even so many as six hundred pages. He has frequently been unable to get at the sources. But his method throughout is that of the careful workman. The footnotes are numerous; the bibliography extends to twenty-five pages; nor does he ever assume that for which there is no basis for assumption.

The task of compiling and writing an "influence" book is one of the hardest that confronts the productive scholar, not because there is a dearth of facts, but because there are ordinarily too many. If there is any one criticism to be made of this work, it is that Mr. Jones erred in his manner of presentation, for fact crowds upon fact so fast that the bewildered reader finds it difficult to leap back and forth from seventeenth to eighteenth century, from New England to the South, from Huguenot emigrant to French *voyageur*. The problem of organization is always a difficult one to handle; Mr. Jones at least hews out a definite pathway through a matted tangle of interesting fact.

The first three chapters of the book are intended to clear away that matter which must be recognized before one can have understanding of the influence any foreign culture may have on a new and growing land. They treat of the rise of conflicting forces in the colonies: the cosmopolitan spirit; the growth of commercialism and the origin of a middle class consciousness; and the romantic, energetic force of the frontier. Then, in two long chapters, the author takes note of French migration to America. His stage now set, he introduces the reader to the French language and its influence, the manners of the Frenchman, his art, religion and his philosophy, all interpreted in terms of the impressions they made on American life. In the last hundred pages, Mr. Jones, discussing the conflicting forces in politics, traces Franco-American relationships down to 1848.

In his concluding statement the author remarks that our culture has had its manners and fashions formed by the French in much greater degree than it has its philosophy and other intellectual matters. On the former there has been real influence; in the field of the latter there has been only vogue.

DOUGLAS L. HUNT.

BURGESS, JOHN W. *The Sanctity of Law: wherein Does it Consist?* Pp. x, 335. Boston: Ginn & Co., 1927.

In sentences strikingly reminiscent of his earlier work, *The Reconciliation of Government with Liberty*, Professor Burgess has recited the story of the western world for freedom. The treatment throughout is historical, and aims to show that changes in government have for the most part occurred because of popular dissatisfaction with the sanction behind the law. There is very little in the book that is new, either in fact or interpretation. The opportunity for a real contribution to the subject in the chapter on the League of Nations is lost through the prejudice of the author against the League. Finally, the style is so unspeakably dull that few readers are likely to find themselves repaid for the struggle necessary to exhume what ideas the book does contain.

WILLIAM S. CARPENTER.

WEATHERLY, ULYSSES G. *Social Progress.* Pp. xviii, 388. Price, $3.00. Philadelphia: J. B. Lippincott, Co., 1926.

The keynote to this volume is found in the preface. "The present book does not attempt a historical survey of the growth of ideas or theories of progress. . . . My method, therefore, is primarily neither historical nor speculative, but pragmatic. Emphasis on the dynamics of change furnishes whatever of unifying principle the work has. . . . I have no single philosophy of progress; in fact, I shall have written in vain, if I have failed to make clear that I believe there is no single principle of progress."

The work is divided into five sections. The first, *Conditions*, Part I (five chapters), deals with such matters as the population, heredity, races and classes, mind in social evolution. Part II, *Attitudes* (six chapters), tells of the reaction to the conditions under such headings as economic determinism and *laissez-faire*, the pessimist, the conservative, radicals and utopians. Part III, *Factors* (six chapters), discusses valuations, scientific spirit, social contacts, leadership and ascendancy. Part IV, *Pathology* (three chapters), treats of the pathology of

progress, stagnation and retrogression, social stereotypes. Part V, *Process and Product* (two chapters), on guidance of social change, and some goals of effort.

It so happens that the writer of this note has had occasion to use this book in recent months. He has found it readable, clear and well documented. Many authorities are cited. The discussion is sensible and not marred by obvious bias. It is a thoughtful and thought-provoking work. It is to be highly commended to those who seek to know something of the underlying problems of our social life, most of all perhaps, to those who confuse bigness and greatness.

CARL KELSEY.

Recent Developments in the Social Sciences. (By the authors named below.) Pp. vii, 427. Price, $3.00. Philadelphia: J. B. Lippincott Co., 1927.

The writers and their topics are: *Sociology*, Charles A. Ellwood; *Anthropology*, Clark Wissler; *Psychology*, Robert H. Gault; *Economics*, J. M. Clark; *Political Science*, J. M. Clark; *History*, H. E. Barnes, and *Cultural Geography*, C. O. Sauer.

He who wishes to know what has been going on in these fields will find here a very convenient summary. No one method is followed. Ellwood, for instance, discusses recent writers and their viewpoints with some attempt at evaluation, while Wissler in the next chapter discusses the problems with no mention of the students though he lists some of them and their books in footnotes.

As a whole the volume is well written and is worth reading. It belongs to the Lippincott Series in *Sociology* edited by Prof. E. C. Hayes of the University of Illinois.

CARL KELSEY.

BOSSARD, JAMES H. S. *Problems of Social Well-Being.* Pp. 654. New York: Harper and Brothers, 1927.

In planning this book on social problems, the author has broken with the traditional method of dealing with "the end-products of social ill-being," the dependents, the defectives and the delinquents in our midst. Instead he stresses the constructive factors making for social well-being. Professor Bossard believes that whatever particular social problem is studied three basic factors tend constantly to appear that, taken together, constitute "the bases of social well-being." The first factor is *economic* in its nature, comprehending the various problems of income; the second, *physical*, with its questions of health and physical welfare; the third, *psychological*, involving problems of mental hygiene.

Accordingly in Part I the author marshals a wealth of facts and up-to-date statistics on "income as a factor in well-being," "standards of living," "wages and incomes in the United States" and family budgets.

Part II discusses with thoroughness such problems of physical welfare as "the control of disease," "infection, resistance, immunity," "the communicable diseases," "the degenerative diseases" and nutrition and health. This section also includes a brief but comprehensive account of the evolution of the public health movement.

In Part III the causes and social significance of mental deficiency are treated. Considerable space is devoted to the social control of the mentally deficient and the problems of mental hygiene.

The author concludes his study with an analysis of changing backgrounds and changing objectives in social well-being. Combining insight into the nature of social problems with a simple and easy flowing style, the author has made not only a real but a readable contribution to the understanding of social well-being viewed in its economic, physical and mental aspects.

FRANK D. WATSON.

PANUNZIO, CONSTANTINE. *Immigration Crossroads.* Pp. viii, 307. Price, $2.50. New York: The Macmillan Company, 1927.

Doctor Panunzio is convinced that it is futile and unnecessary to attempt the artificial regulation of population movements by either the country of emigration or that of immigration beyond that which would restrict the migration of individual defectives obviously unfit to take up the struggle for existence in a strange land. He believes that so long as one nation possesses economic and social advantages over an-

other, people will succeed in crossing borders in spite of restrictive legislation and guards. Further, he believes that in the long run all parties concerned will benefit by this equalizing process. *Immigration Crossroads* is likely to produce the same convictions in those readers who approach it without too much bias against the alien.

It would be easy to charge the author with a strong bias of the opposite sort, for throughout his work a point of view accepting the immigrant as a valuable element in our population is evident. There is constant opposition to laws which restrict solely on the basis of mere numbers or race rather than on one of individual ability. The searching student of population may regret that more of the material available as evidence on the question of immigrant desirability has not been included, but the absence of tedious statistical tables and the omission of all but a minimum of reference citations has helped to make this study one of the few revamped doctoral dissertations which can be read understandingly with ease and profit by the interested layman. A merit such as this does much to offset any charges of "propaganda" which may be levied because of the omission of elaborate references, footnotes, appendices and meticulous documentation.

As a straightforward readable statement of the value of the immigrant in the development of the United States and of the nature and causes of the opposition to his admittance to our country, this book can be highly recommended.

DONALD YOUNG.

RADIN, PAUL. *The Story of the American Indian.* Pp. xiv, 371. Price, $5.00. New York: Boni & Liveright, 1927.

The Story of the American Indian is to Doctor Radin a story of cultural diffusion and modification, with an emphasis on North American tribes which throws the work somewhat out of balance. Most of the chapters are delightfully clear and absorbing: two or three become tedious with constant attempts to show this cultural trait was borrowed by that tribe, an offshoot of some other tribe, which modified the aforementioned trait by adding this or subtracting that, a process similar to one which took place earlier among their cousins in the West. Omission of all footnotes and the index shows the author's desire to write a readable story for the nontechnical public. With the exception of a number of these detailed cultural and tribal genealogies (fortunately few in number, for the layman does not need them) Doctor Radin has accomplished his purpose. There is no better single study of the American Indian to which the general reader can be referred.

Improvement might result from the addition of a few language, tribal and culture trait maps, a glossary of Indian names and terms with which the ordinary reader is not too familiar, and at least an abbreviated index. Also, *The Story of the American Indian* can hardly be said to be complete if practically nothing is said about his nineteenth-century contacts with the white man.

This book will do much to counteract the popular impression of the Indian as a "savage," though possibly a noble one, with few or no institutional or material cultural achievements worth mentioning in the presence of a twentieth-century white product of Western civilization. Many ethnologists will insist that the author has painted too glowing a picture of the aboriginal American, but perhaps this exaggeration, like some of the other faults referred to, is only a teacher's device made necessary by the previous bias of his pupils.

DONALD YOUNG.

CARTER, HUGH. *The Social Theories of L. T. Hobhouse.* Pp. viii, 137. Chapel Hill University of North Carolina Press, 1927.

NICHOLSON, J. A. *Some Aspects of the Philosophy of L. T. Hobhouse.* Pp. 86. University of Illinois, Urbana, 1928.

Critical estimates of the writings of L. T. Hobhouse are becoming quite the vogue. Two volumes on the subject, from the pens of two different authors, have recently appeared. Mr. Nicholson's study, however, is less a criticism than a description, while Dr. Carter's work is an evaluation of Hobhouse's theories.

Mr. Nicholson is interested in the phi-

losophy of the British scholar. He traces in some detail the development of Hobhouse's views from "The Theory of Knowledge" to the recent "Principles of Sociology." He writes accurately and sometimes with surprising penetration, but not always with literary skill. Occasionally the sentence structure is hopelessly involved.

Dr. Carter emphasizes Hobhouse's social theories. He paints with vivid strokes a picture of the Englishman bridging the gap between philosophy and the social sciences. Prehuman adaptation in the evolutionary process, the broad lines of social evolution, social theory and present world problems—these are a few of the subjects considered. The style is excellent, and the text highly readable throughout.

Both volumes should be eagerly welcomed by students of the social sciences. They help to round out the literature of the field. And they will have accomplished their purpose if they bring about a more sympathetic appreciation of that brilliant thinker—L. T. Hobhouse.

A. F. M.

SELIGMAN, E. R. A. *The Economics of Instalment Selling.* 2 vols., Pp. xii, 980. Price, $8.00. New York and London: Harper & Brothers, 1927.

The first volume of this elaborate study contains a scholarly piece of work by Professor Seligman; the second includes the results of a series of intensive investigations carried on under his supervision by a number of his associates among whom are Mr. Robert A. Love, Professor George Filipetti, Professor Archibald H. Stockder, Mr. Solomon S. Kuznets and Mr. Ralph W. Roby.

The first part of Volume I, described as "Historical and Statistical," traces the subject of instalment selling historically; presents an account of modern instalment selling methods; and sets forth statistics on the volume of sales. The second part of Volume I, described as "Analytical," analyzes the nature and characteristics of instalment credit, and discusses its effects at considerable length. Volume II is composed of five special investigations which are termed the Consumers' Study, the Merchandise Study, the Dealer Study, the Repossession Study, and the Depression Study. These investigations, conducted according to the scientific method, provide the factual foundation of the whole study.

Professor Seligman in his analysis of the facts throws much light on the difficult problems of instalment selling. Where facts are inadequate on account of the present state of the researches in the subject, he resorts to deductive reasoning and in each case follows the reasoning through to logical conclusions.

His conclusions as given in the final paragraph of Volume I are as follows:

> Summing up the entire matter, we should say that instalment selling, like every new institution, is subject to the perils of novelty. It has engendered new devices and has created a new technique, but it has undoubtedly come to stay. Some abuses and perils which it was shortsighted to deny have crept in. What is needed is to apply to each particular case some of the results of the analysis which we have attempted to present. As the years roll by, experience will teach us to what classes of commodities and to what strata of society instalment selling is economically applicable. In the course of time outworn methods will be discarded and new abuses will undoubtedly appear. Is it not the part of wisdom to separate the chaff from the grain, to be on our guard against the obvious dangers, and to eliminate one by one the improper practices until, precisely as in the case of our banking structure, we may be able to establish fairly definite and generally accepted standards for distinguishing the sound from the unsound, the real from the specious? When instalment selling comes to be measured by these criteria, we may expect to learn that the innocuous and the salutary must not be confounded with the inappropriate and the regrettable, and that, in its ultimate and refined forms, instalment credit will be recognized as constituting a significant and valuable contribution to the modern economy.

In the preface, Professor Seligman says that some time previous to his undertaking the investigation there appeared in a weekly periodical an article which sang a funeral dirge over political economy, and which declared that the bankruptcy of economics was illustrated by the failure of its votaries to attack the subject of instalment selling. It was partly to defend the science against this indictment, he con-

tinues, and to show its competence to deal with an important practical problem that he was led to undertake this study. It is our judgment that Professor Seligman has been eminently successful in accomplishing the thing he set out to do. He has produced a work which will be exceedingly useful to all those seeking information on any phase of instalment selling.

WILBUR C. PLUMMER.

FAY, C. R. *Elements of Economics.* Pp. xviii, 631. New York: Macmillan Co., 1927.

A secondary school text in economics, principles and problems, well illustrated with graphs, tables and reproductions of business forms, and containing questions, exercises and references at the end of each chapter. An excellent high school text in general economics, stressing its practical and business aspects, rather than the social, political and historical phases of economics.

S. H. PATTERSON.

HOLLANDER, J. H. and GREGORY, T. E. *Notes on Malthus' "Principles of Political Economy" by David Ricardo.* Pp. cvi, 246. Price, $5.00. Baltimore: Johns Hopkins Press, 1928.

Notes on Malthus' "Principles of Political Economy" was written by Ricardo in 1820 as a commentary on *Principles of Political Economy* by Thomas Malthus. Although Ricardo's friend, James Mill, influenced him to publish his famous *Principles of Political Economy and Taxation*, he also is said to have induced him to refrain from printing his *Notes on Malthus' "Principles of Political Economy,"* because of its controversial nature.

After the death of Ricardo his printed works and unpublished manuscripts were collected and published under the editorship of McCulloch. But the *Notes on Malthus' "Principles of Political Economy"* were omitted by McCulloch, because "we doubt whether they have sufficient interest to warrant their publication."

This manuscript of Ricardo subsequently disappeared, and it has been referred to for decades as the lost *Notes on Malthus.* It was not until 1919 that the missing manuscript of Ricardo was discovered among some old furniture by Mr. Frank Ricardo, a great-grandson of the illustrious English economist.

Students of the history of economic thought will rejoice in the publication of Ricardo's *Notes on Malthus' "Principles of Political Economy."* Much light will be shed on many controversial points and on certain obscure passages in other works of both Malthus and Ricardo. Attention will also be called to *Principles of Political Economy* by Thomas Malthus, whose famous *Essay on Population* has thrown into relative obscurity his other writings on economics.

The editing of the notes has been carefully done by Professor Gregory of the University of London, and Professor Hollander of Johns Hopkins University has written an introduction of a hundred pages. The latter, as well as the former, is a valuable contribution to the history of economic thought. The volume is attractive in appearance, which is befitting such an outstanding contribution among the semicentennial publications of the Johns Hopkins Press.

S. H. PATTERSON.

BUSINESS MEN'S COMMISSION ON AGRICULTURE. *The Condition of Agriculture in the United States and Measures for its Improvement.* Pp. xii, 273. Published jointly by National Industrial Conference Board, New York, and Chamber of Commerce of the United States of America, Washington, D. C., 1927.

This is a report by a commission of ten prominent business men to its two sponsor organizations,—the National Industrial Conference Board, and the United States Chamber of Commerce. The Commission was given entire freedom in making its study, and the conclusions and recommendations drawn are its own and independent of the views of the appointing bodies.

An attempt was made to accomplish two things: first, to comprehend the agricultural situation in the United States at the present time; and second, to review and suggest measures for its relief. The Commission accordingly reviewed the facts available from the usual sources, and in addition held many hearings in various parts of the coun-

try. It heard and weighed many points of view, and the results of this survey are brought together in the report: facts, opinion, and remedies.

The Commission is struck by the complexity of the agricultural situation and the difficulty of finding an adequate solution. It suggests a gradual downward revision of the tariff having "due regard for the situation that has been established." It also suggests the establishment of a Federal Farm Board to aid in the stabilization of farm prices and production. This suggestion is elaborated upon somewhat, and constitutes perhaps the leading constructive proposal. The Commission disapproves all legislative proposals which aim to raise the domestic price of agricultural commodities.

Perhaps the leading destructive criticism to be made of a report of this kind is that it relies too largely upon general observations. While there is a certain amount to be gained by hearings and interviews, the information thus gained is of far greater value if used in connection with a detailed analysis of available statistical data. This point is well illustrated in the Commission's discussion of the influence which government regulation of produce exchanges has had upon prices (pp. 115–116). They state in general that because of government regulation "it seems not improbable that the cost of marketing may have been enhanced," and in particular that "it was for a time required that all small trades should be reported daily to the government bureau by the various houses handling such trades." The first of these statements certainly needs to be proven; the second is untrue.

WRIGHT HOFFMAN.

ENGBERG, R. C. *Industrial Prosperity and the Farmer.* Pp. xiii, 286. New York: The Macmillan Co., 1927.

This is a publication of the Institute of Economics, being one of their series of investigations in agricultural economics. Mr. Engberg in this study attempts to answer the following threefold problem:

1. To what extent are business cycles responsible for farmers' recurrent financial difficulties?
2. Is it worth while for farmers to attempt to adjust their production policies to changes in demand or costs predicted on business forecasts?
3. Are the remedies suggested for business cycles likely to prove effective in stabilizing agricultural production and prices?

The author's answer to these questions is in each case negative. To arrive at this conclusion an extensive marshalling of material and studies, bearing on each phase of the problem, is made. The analysis consists largely of correlation studies in which the author finds that weather, plant disease, and insect pests, through yield, play a far more important rôle in determining fluctuations in agricultural prices than do variations in business conditions. On the relation of weather to yield the author might well have cited the studies of Wallace, Smith, Kincer and others. On the whole, the study is well done and the conclusions seem justified.

WRIGHT HOFFMAN.

HULVERSON, GEORGE R. *Personnel.* Pp. 400. New York: The Ronald Press.

Mr. Hulverson's book on *Personnel* is one of the Business Administration Series, edited by James O. McKinney. Its purpose is to "summarize the principal features of the best known methods of personnel administration and the limitations to be borne in mind in applying them, in a comprehensive view which will enable the executive to select for his own use those plans which will be most helpful." In general, one can recommend the book as far as it goes; for the topics fully discussed, such as job analysis, sources of labor supply, methods of selection, wage determination and control, transfers, promotion and training, are dealt with clearly and dispassionately. Mr. Hulverson's feet are always on the ground and never at any time stray into what may be called the philosophy of personnel. He does not hesitate to tackle fearlessly the problem of wage control. His attempt, it is true, is not entirely satisfying, but it is none the less an interesting attack on a major problem in employee relationships. Though he does not support his statements with cases or references and the suggested bibliography at the end of the book is very inadequate, one has the feeling

that his reasoning and conclusions are buttressed by practical and ripe experience.

The book, however, fades away toward the close when the author lumps the questions of employee insurance, legal aid, restaurant management, mutual benefit plans, recreation, saving plans, medical service—accident prevention and first aid, and improvement of morale in a final chapter of nine pages, headed "Personal Service Work." Furthermore, no mention is made anywhere of the problems raised by the collective methods of dealing with workers. Shop councils and unions of all kinds seem to Mr. Hulverson not even worthy of mention. Unless Mr. McKinney plans another book dealing with these problems, the Business Administration Series can hardly be said to be complete from the standpoint of personnel problems.

REX B. HERSEY.

SMITH, ELLIOTT DUNLAP. *Psychology for Executives—A Study of Human Nature in Industry.* Pp. xii, 262. Price, $3.50. New York: Harper and Brothers.

For men who are dealing with individuals and wish a book analyzing motives and replete with factory illustrations, this volume is certainly a fine addition to the field. In a word, it certainly gives theory and practice a new coördination. Group management, through an understanding of fundamental mental operations, is the method throughout. The human aspects of handling groups and of managing through the use of this knowledge is the spirit in which the book is written. It is the reviewer's opinion that the suggestion for teaching set forth in Appendix I may be the part of the book most likely to raise differences of opinion.

J. RUSSELL DOUBMAN.

LYNCH, DENIS TILDEN. *"Boss" Tweed: The Story of a Grim Generation.* Price, $4.00. New York: Boni & Liveright.

Tweed's name is synonymous with political manipulation and venal corruption, and Mr. Lynch, an old and practiced journalist, has told the story of New York's most sordid period, with great force and effect. We have here anecdotes, racy accounts of events that had become mere echoes, pen pictures of the men of the period, men like Fernando Wood, Oakey Hall, "Jim" Fisk, Beecher, Theodore Tilton, Jay Gould, in fact all the coterie of those financiers and politicians, who made the period notorious. Nor were the women of the time neglected, especially those who figured in the hours of pleasures of the chief character and his friends and associates.

It is only fair to say that the book is highly interesting as a piece of clever journalism. It has, however, but slight value as a contribution to history or politics. It is entirely lacking in documentation and is inadequately indexed. It will be read as any well-written newspaper account of a period, or of a series of events or of a group of men; but it will scarcely be quoted as an authority. There is a five-page bibliography and a statement that government documents and newspapers have been consulted, but they are not specifically referred to, so that further investigation might be followed up.

There is no analysis of character; no discussion of causes and effect; no attempt to show how Tweed came to be, or of the underlying influences that led to his overthrow. There is no attempt to discuss the philosophy, conscious or otherwise, of Wood or Tweed or their confrères. It cannot even be classified as a human document. It may have more value than a well-written novel, although those like Theodore Dreiser's *The Financier* and its sequel, *The Titan* really afford better pictures, and give a deeper insight into underlying causes.

CLINTON ROGERS WOODRUFF.

BINKLEY, W. E. *Problems and Exercises in American Government.* Pp. 95. Published by the author, Ada, Ohio, 1926.

This is a teaching device based upon a number of years' experience with college classes. Following in general the usual organization of the more widely current textbooks in this field, and including reading assignments to these texts, the work consists essentially of series of questions under each topic which involve a great deal more than merely finding the answer in a textbook. These questions are thought-provoking, conducive to really active class debate, suggestive of further questions.

Some are factual, but the facts must be sought for, and the process of seeking facts is an entirely different one than that of merely absorbing them. This manual deserves a wide adoption; its general use would transform college courses in American Government.

WALTER JAMES SHEPHARD.

WRIGHT, H. E. *The Financing of Automobile Installment Sales.* Pp. ix, 86. Chicago & New York: A. W. Shaw Company.

Prize Monograph, Chicago Trust Co. prizes for research relating to business development and the modern trust company.

WARDWELL, CHARLES A. R. *An Investigation of Economic Data for Major Cycles.* Pp. 140 and Appendix. Doctor's thesis published by the author, the University of Pennsylvania, Philadelphia, Pa., 1927.

LOGAN, EDWARD BATES. *Supervision of the Conduct of Elections and Returns.* Pp. v, 156. Doctor's thesis published by the author, the University of Pennsylvania, Philadelphia, Pa., 1927.

NATIONAL INDUSTRIAL CONFERENCE BOARD. *Supplemental Bonuses for Wage Earners, Supervisors and Executives.* Pp. 160. New York City; National Industrial Conference Board, 1928.

INDEX

Some Comments on

PROGRESS IN THE LAW

Edited by

JOHN S. BRADWAY

March, 1928, Issue of THE ANNALS

A commendable endeavor by the legal profession to get to the public some adequate notion of present day law and justice has impelled the American Academy of Political and Social Science to devote its March Annals entirely to a discussion of some of the tendencies of the law and the administration of justice to adapt themselves to modern social and economic life.

John S. Bradway, editor-in-chief of this issue gives appropriate introduction to his seventy-five contributors. These writers are all able, qualified professional men who are actively engaged in work related to the subjects about which they write. Dean Roscoe Pound of Harvard Law School prepares the background for the readers so that they may understand the present day legal problems. The discussion is then divided into six parts: Changes in substantive law; Progress in the Resources of the Law for Disposing of Problems; Progress in civil courts; Progress in criminal courts; Progress in the Bar and Progress in law making.

From these short discussions the lay reader will get some understanding of the enormous problems that confront the law and the serious effort that is being made to solve them. They are vital, practical talks about our present day law.
—MUNICIPAL REFERENCE LIBRARY NOTES—April 25, 1928.

Under the title "PROGRESS IN THE LAW" the American Academy of Political and Social Science has published in THE ANNALS for March, 1928, articles of unusual importance. In general, consideration is given to changes in substantive law; progress in dealing with specific problems; progress in the procedure of civil and criminal courts; progressive steps taken by the bar; and the inauguration of instrumentalities to facilitate law-making.

Those who are inclined to be disheartened with the lack of progress along these lines will be edified by this survey of developments treated in popular form by specialists.
—INFORMATION SERVICE — April 28, 1928.